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Lunar LEM Rocket (by Jim Storer, Eric Peters, William Labaree II, David Ahl)

# Lunar LEM Rocket

This game in its many different versions and names (ROCKET, LUNAR, LEM, and APOLLO) is by far and away the single most popular computer game. It exists in versions that start you anywhere from 500 feet to 200 miles above the moon, or other planets, too. Some allow the control of directional stabilization rockets and/or the retro rocket. The three versions presented here represent the most popular of the many variations.

In most versions of this game, the temptation is to slow up too soon and then have no fuel left for the lower part of the journey. This, of course, is disastrous (as you will find out when you land your own capsule)!

LUNAR was originally in FOCAL by Jim Storer while a student at Lexington High School and subsequently converted to BASIC by David Ahl. ROCKET was written by Eric Peters at DEC and LEM by William Labaree II of Alexandria, Virginia.

In this program, you set the burn rate of the retro rockets (pounds of fuel per second) every 10 seconds and attempt to achieve a soft landing on the moon. 200 lbs/sec really puts the brakes on, and 0 lbs/sec is free fall. Ignition occurs at 8 lbs/sec, so *do not* use burn rates between 1 and 7 lbs/sec. To make the landing more of a challenge, but more closely approximate the real Apollo LEM capsule, you should make the available fuel at the start (N) equal to 16,000 lbs, and the weight of the capsule (M) equal to 32,500 lbs in Statement 15.

Some versions of BASIC object to the series expansion calculations in Statements 420 and 430 (as you near the lunar surface, these numbers get very small). If your does, substitute the following expanded form for the expansion in Statement 420:

$$-Q^*(1+Q*(1/2+Q*(1/3+Q*(1/4+Q/5))))$$

You should be able to figure the other one out yourself.

LUNAR  
CREATIVE COMPUTING MORRISTOWN, NEW JERSEY

THIS IS A COMPUTER SIMULATION OF AN APOLLO LUNAR LANDING CAPSULE.

THE ON-BOARD COMPUTER HAS FAILED  
SO YOU HAVE TO LAND THE CAPSULE MANUALLY.

SET BURN RATE OF RETRO ROCKETS TO ANY VALUE BETWEEN  
0 (FREE FALL) AND 200 (MAXIMUM BURN) POUNDS PER SECOND.  
SET NEW BURN RATE EVERY 10 SECONDS.

CAPSULE WEIGHT 32,500 LBS; FUEL WEIGHT 16,500 LBS.

### GOOD LUCK

SEC	HI + FT	MPH	LB FUEL	BURN RATE
0	120 0	3600	16500	? 0
10	109 5015	3636	16500	? 0
20	99 4223	3672	16500	? 0
30	89 2903	3708	16500	? 0
40	79 1055	3744	16500	? 0
50	68 3959	3780	16500	? 0
60	58 1055	3816	16500	? 0
70	47 2903	3852	16500	? 200
80	37 1883	3882.87	14500	? 200
90	28 1191	3086.71	12500	? 200
100	20 1251	2659.65	10500	? 200
110	13 2549	2196.95	8500	? 200
120	8 370	1692.63	6500	? 100
130	3 3778	1440.59	5500	? 75

ON MOON AT 139.924 SECONDS - IMPACT VELOCITY 1253.25 MPH  
SORRY THERE WERE NO SURVIVORS. YOU BLEW IT!  
IN FACT, YOU BLASTED A NEW LUNAR CRATER 347.15 FEET DEEP!

### TRY AGAIN??

```

10 PRINT TAB(33);"LUNAR"
20 PRINT TAB(15);"CREATIVE COMPUTING MORRISTOWN, NEW JERSEY"
25 PRINT:PRINT:PRINT
30 PRINT "THIS IS A COMPUTER SIMULATION OF AN APOLLO LUNAR"
40 PRINT "LANDING CAPSULE.": PRINT: PRINT
50 PRINT "THE ON-BOARD COMPUTER HAS FAILED (IT WAS MADE BY"
60 PRINT "XEROX) SO YOU HAVE TO LAND THE CAPSULE MANUALLY."
70 PRINT: PRINT "SET BURN RATE OF RETRO ROCKETS TO ANY VALUE BETWEEN"
80 PRINT "0 (FREE FALL) AND 200 (MAXIMUM BURN) POUNDS PER SECOND."
90 PRINT "SET NEW BURN RATE EVERY 10 SECONDS.": PRINT
100 PRINT "CAPSULE WEIGHT 32,500 LBS; FUEL WEIGHT 16,500 LBS."
110 PRINT: PRINT: PRINT "GOOD LUCK"
120 L=0
130 PRINT: PRINT "SEC","HI + FT","MPH","LB FUEL","BURN RATE":PRINT
140 A=120;V=1;M=33000;N=16500;B=1E-03;Z=1.8
150 PRINT L,INT(A);INT(5280*(A-INT(A))),3600*V,M-N,:INPUT K:T=10
160 IF M-N<1E-03 THEN 240
170 IF T<1E-03 THEN 150
180 S=T: IF M>=M+S*K THEN 200
190 S=(M-N)/K
200 GOSUB 420: IF I<=0 THEN 340
210 IF V<=0 THEN 230
220 IF J<0 THEN 370
230 GOSUB 330: GOTO 160
240 PRINT "FUEL OUT AT";L;"SECONDS":S=(-V+SQR(V*V+2*A*B))/B
250 V=V+B*S: L=L+S
260 M=3600*V: PRINT "ON MOON AT";L;"SECONDS - IMPACT VELOCITY";M;"MPH"
270 IF W<=1.2 THEN PRINT "PERFECT LANDING!": GOTO 440
280 IF W<=10 THEN PRINT "GOOD LANDING (COULD BE BETTER)":GOTO 440
282 IF W>60 THEN 300
284 PRINT "CRAFT DAMAGE... YOU'RE STRANDED HERE UNTIL A RESCUE"
286 PRINT "PARTY ARRIVES. HOPE YOU HAVE ENOUGH OXYGEN!"
288 GOTO 440
300 PRINT "SORRY THERE WERE NO SURVIVORS. YOU BLEW IT!"
310 PRINT "IN FACT, YOU BLASTED A NEW LUNAR CRATER";M*.277;"FEET DEEP!"
320 GOTO 440
330 L=L+S: T=T-S: M=M-S*K: A=I: V=J: RETURN
340 IF S<5E-03 THEN 260
350 D=V+SQR(V*V+2*A*(B-Z*K/M)):S=2*A/D
360 GOSUB 420: GOSUB 330: GOTO 340
370 W=(1-M*B/(Z*K))/2: S=M*V/(Z*K*(U+SQR(W*U+V/Z)))+.05:GOSUB 420
380 IF I<=0 THEN 340
390 GOSUB 330: IF J>0 THEN 160
400 IF V>0 THEN 370
410 GOTO 160
420 D=S*K/M: J=V+B*S+Z*(-B-D*0/2-0^3/3-0^4/4-0^5/5)
430 I=A-B*S/2-V+S+Z*S*(B/2+0^2/6+0^3/12+0^4/20+0^5/30):RETURN
440 PRINT:PRINT:PRINT:PRINT "TRY AGAIN?": GOTO 70
    
```