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TITLE	APOLLO 12
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SOURCE LANGUAGE	FOCAL-12

APOLLO 12

1 - Abstract.

This is a modification of the program "Moon Landing" written for FOCAL-8 and published in DEC-08-XJFB-D "Focal Demonstration Programs" by D.E.C.

The program simulates the Apollo capsule descending on the moon. The operator governs the fuel rate by means of a potentiometer of the A-D converter, or through the use of the sense switches. The process is simulated in true real time, through the use of the real-time clock.

2 - Description.

The initial conditions are the following:

- a) The capsule is at 120 miles of the moon surface
- b) The velocity in the vertical direction (the only direction considered) is 3600 miles per hour
- c) The tank contains 16.500 lbs. of fuel

When the program begins to run, it displays an horizontal line, and six indicators:

- 1) Time in seconds (begins in \emptyset)
- 2) Amount of fuel remaining in the tank (begins in 16.500 lb)
- 3) Altitude in miles and feet (begins in 120 miles)
- 4) Fuel rate (begins in \emptyset)
- 5) Velocity in miles per hour (begins in 3600 MPH)

Immediately the program interrogates the channel \emptyset of the A-D converter and sets the fuel rate according to its value, in the range of 8-200 lbs. or \emptyset lbs. Since then, the program repeats this procedure every one second actualizing the indicators and the time-altitude diagram.

In this way the process can be seen as it develops, in true real time. The operator must set the fuel rate with the potentiometer of channel \emptyset . When the altitude becomes 1 mile, the diagram is scaled in the vertical axis to \emptyset to 1 mile full scale, so the last part of the trajectory can be clearly viewed.

The process ends when one of the two following conditions are met:

- a) The capsule reaches the moon surface, that is, the altitude becomes \emptyset . Then the following parameters are displayed:
IMPACT VELOCITY: (MPH)
FUEL LEFT: (LBS)

and some comment about the goodness of the landing:

Between 0 and 1 mile/hour: PERFECT!!
Between 1 and 10 miles/hour: GOOD!
Between 10 and 25 miles/hour: POOR!
Between 25 and 60 miles/hour: DAMAGED!
Above 60 miles/hour: CATASTROPHE!

b) The fuel has been totally consumed. The program displays the message: "FUEL OUT" and proceeds as in case a).

3) Differences between versions 1 and 2.

Version 1: uses the channel \emptyset of the A-D converter to set the fuel rate. The range is 0-200 lbs., but the program will set to \emptyset every value below 8 lbs.

Version 2: to protect the potentiometers against enthusiastic players (also considering that sometimes an abrupt increase or decrease of the fuel rate is necessary), this version uses the sense switches.

It is necessary to use the "\$ SNS" overlay to FOCAL-12 described in DECUS FOCAL-12-24" Overlays to FOCAL-12". The program uses sense switches 2 to 5, through the use of the FX (J) function. The fuel rate is the sum of the values corresponding to the sense switches set to 1:

Sense switch 2	=	140
"	"	3 = 60
"	"	4 = 22
"	"	5 = 8

The maximum will be 200 lbs. when all switches No. 2 through 5 are set to 1. The minimum is 8 lbs. according to SSW5, and zero is all sense switches set to zero.

4) Hint: Leaving the fuel rate equal to zero for the first 71 seconds or beyond, will result in a "catastrophe".

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*0-    AF0LL012
*0-
*0-    VERSION 2: USES SENSE SWITCHES 2 TO 5 TO SET FUEL RATE.
*0-    OVERLAY "$SNS" DESCRIBED IN DECUS FOCAL12-24 IS NEEDED.
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C FOCAL-12

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01.10 S H1=120;O I,1;F J=w,.01,1.38;S H=FDIS(J,w);O
02.05 S L=0;S A=120;S V=1;S M=33000;S N=16500;S G=.001;S Z=1.8
02.10 O E;I Z3,L," SEC " ,FITR(A)," MLS "
02.11 T Z4,5230*(A-FITR(A))," FT"!!
02.20 T Z6.02,(M-N)," LB",K," LB/SEC " ,3600*V," MPH";S T=1
02.30 I (1-A)*0.4;S H1=1;
02.40 S H=FDIS(L/240,A/H1);O I
02.50 S A=FX(5)*6+FX(4)*22+FX(3)*60+FX(2)*110

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03.10 I (M-N-.001)*4.1;I (1-.001)*2.1;S S=T
03.40 I (N+S*K-M)*3.5,3.5;S S=(M-N)/K
03.50 D 9;I (D)7.1,7.1;I (V)3.4,3.8;I (J)6.1
03.60 D 6;G 3.1

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04.10 T !,"FUEL OUT",!
04.40 S S=(V+FSQRT(V*V+2*A*G))/G;S V=V+G*S;S L=L+V

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05.10 S w=3600*V;I !,"IMPACT VELOCITY",w," MPH"!
05.20 T !,"FUEL LEFT",(M-N)," LB"!!;I (1-w)5.5,5.5
05.40 T !,"FUEL FCT !!";O
05.50 I (1-w)5.6,5.6;T !"GOOD !";O
05.60 I (20-w)5.7,5.7;T !"POOR..";O
05.70 I (60-w)5.8,5.8;T !"DAMAGED";O
05.80 T !"CATASTROPHE.";O

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06.10 S L=L+S;S T=T-S;S M=M-S*K;S A=I;S V=J

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07.10 I (S-.005)*5.1;S S=2*A/(V+FSQRT(V*V+2*A*(G-Z*K/P)))
07.30 D 9;D 6;G 7.1

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08.10 S w=(1-M*G/(Z*K))/Z;S S=M*V/(Z*K*(w+FSQRT(w*w+V/Z)))+.05;D 9
08.30 T (D)7.1,7.1;D 6;I (-,D)3.1,3.1;I (V)3.1,3.1,8.1

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09.10 S U=S*K/M;S J=V+G*S+Z*(-U-U+2/2-U+3/3-U+4/4-U+5/5)
09.40 S I=A-G*S*S/2-V*S+Z*S*(C/2+U+2/6+U+3/12+U+4/20+U+5/30)

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