Fuel in kg	**Altitude in mi**	**Velocity in mph**
1200	1453.54	27075.99
1201	1527.28	28299.76
1205	1516.68	28074.51
1208	1508.79	27907.37
1209	1506.17	27851.99
1210	1503.56	27796.78
1225	1541.16	28251.91
1250	1551.78	28114.57
1300	1571.21	27931.79
1400	1680.01	28664.72

I think that the minimum amount of fuel that we need to get the rocket to at least 1500 mi is 1201 kg of fuel. After repeated runs of the simulation, 1201 kg of fuel is the minimum amount of fuel that gets the rocket at least past 1500m.

General Code:

```
% Rocket Project, Take 1
% Deepak Warrier
% September 22, 2016

clc;
clear all;
close all;

g = 9.8; % acceleration of gravity
thrust = 25000; % thrust of the rocket motor in Newtons (kg*m/s^2)
rocketMass = 400; % mass of the rocket itself in kg
fuel = 1201; % mass of fuel in kg
burnRate = 2; % rate of rocket fuel burn in kg/second
mass = rocketMass+fuel; % mass of the rocket in kg
%burnTime = 30; % burn time of the rocket in seconds
stopTime = 300; % time (in seconds) when the simulation stops
timeStep = 10; % time step size for the simulation (every 0.1 seconds)
v(1) = 0; % rocket velocity in m/s
vY(1) = 0; % Velocity in x direction
vX(1)= 0; % Velocity in y direction
downRange(1) = 0; % rocket downRange in m
altitude(1) = 0; % rocket altitude in m
time(1) = 0; % time since launch, in seconds
fuel(1)=fuel;
angle = 85;
earth = 6400000; % Earth's radius in meters
g(1) = 9.8; % acceleration of gravity


i=1;
while(fuel(i)>0)
        if(fuel(i)>0)
                vY(i+1)=vY(i)+((thrust*sind(angle))/mass-g(i))*timeStep;
                vX(i+1)=vX(i)+(thrust*cosd(angle)/mass)*timeStep;
        else
                vY(i+1)=vY(i)-g*(timeStep);
                vX(i+1)=vX(i);
        end
        avgVelY=(vY(i+1)+vY(i))/2;
        avgVelX=(vX(i+1)+vX(i))/2;
        v(i)=(vX(i+1)^2+vY(i+1)^2)^.5;
        downRange(i+1)=downRange(i)+avgVelX*timeStep;
        altitude(i+1)=altitude(i)+avgVelY*timeStep;
        time(i+1)=time(i)+timeStep;
        fuel(i+1)=fuel(i)-timeStep*burnRate;
```

```
        mass=rocketMass+fuel(i+1);
        g(i+1)= ((earth^2)*g(1))/((altitude(i+1)+earth)^2);
        i=i+1;
end
printf('\n');
disp(fuel(1))
printf('Max Altitude: %.2f m\n', max(altitude));
printf('Max Down Range: %.2f m\n', max(downRange));
printf('Max Altitude: %.2f mi\n', (max(altitude)/1609.34));
printf('Max Down Range: %.2f mi\n', (max(downRange)/1609.34));
printf('Max Velocity: %.2f m/s\n', (max(v)));
printf('Max Velocity: %.2f mph\n', (max(v)*2.23694));
%disp(min(g));


%max(altitude)
%max(downRange)
%max(time)

plot(time, altitude, time, downRange);
title('Altitude/Distance v. Time @ 80 degrees');
xlabel('Time (in seconds)');
ylabel('Altitude/Distance (in meters)');
legend('Altitude','Distance');
```