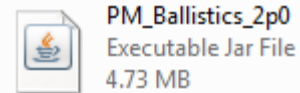# Instructions for using the
Point Mass Ballistics Solver 2.0
Computer Program

Overview

This ballistics program was designed to be an educational tool, as well as a functional and accurate program for generating useful trajectory data. The solver is a 3 Degree Of Freedom (3-DOF) numerical point mass simulation which solves the equations of motion using a 4th order Runge-Kutta integration. The solution is as accurate as the inputs.

Getting Started

There is no installation required to get this software working. All you need to do is copy the program from the CD onto your computer. This can be done by either dragging and dropping the icon from the CD or by right clicking on the icon and selecting *copy,* then clicking where you want the program located on your computer (the desktop for example), then right clicking again and selecting *paste.* In order to run the program, simply double click on the icon and it will open up.

PM_Ballistics_2p0
Executable Jar File
4.73 MB

If the program doesn't open up when you double click on it, it may be because your computer doesn't have new enough Java. Java is a common computer language that enables your computer to run applications. If the program doesn't work for you, simply go to this website:

http://www.java.com/en/download/index.jsp

And click the *free Java Download* button.

Free Java Download

Download Java for your desktop computer now!

Version 6 Update 24

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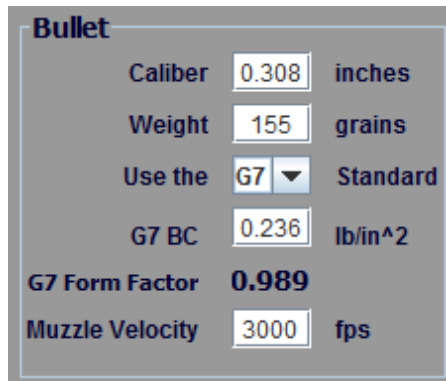# Program Input

There are 5 different categories of inputs:
- Bullet data
- Atmosphere
- Sights
- Stability
- Output Options

You can switch between English and Metric units by clicking on the radio buttons in the upper right corner of the program window. The following sections will explain the meaning and details of each input.

Bullet Data

The first bullet input is the bullet caliber. This is an easy one. The units are inches; remember to include the decimal point. Do not input any cartridge titles here like 7mm, 30-06, etc. Only inches beginning with a decimal point.

Next is the bullet weight, in grains.

The next item is a drop down menu that allows the user to select either the G7 or G1 standard. There is a lengthy discussion in Chapter 2 about this subject. The gist is that you should use BC's referenced to the G7 standard for long range bullets. When running the program, *it's imperative that if you select the G7 standard, that you're giving it a G7 BC. Likewise, if you select the G1 standard, you have to give it a G1 BC.* Failing to match the standard with the BC will result in meaningless output.
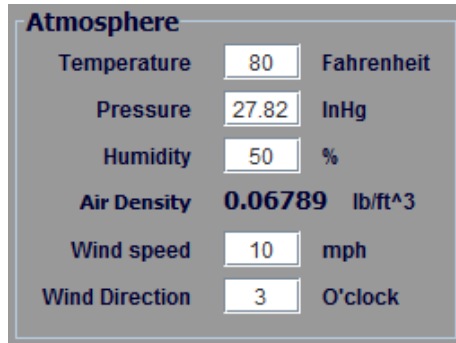
Next is the BC of the bullet. As stated above, the BC that you enter must coincide with the standard you have selected in the drop down menu (G1 or G7). Traditionally, all BC's advertised by bullet makers and discussed in the world of small arms shooting are G1 BC's. If a BC is given somewhere and it doesn't say if it's referenced to G1 or G7, it's a good bet that it's a G1 BC.

The field below the BC input is an output that shows you what form factor results from the previous 3 inputs. In other words, given the caliber, weight, and BC, the program displays the form factor referenced to whichever standard you have selected. This can be used as a sanity check to insure the inputs above are somewhat reasonable.

The final input in the bullet data category is the muzzle velocity. The only trick to this input is that you have to add a few feet per second to a chronograph reading that's taken several yards downrange from the muzzle. This is a small detail, but the details add up. Typically, a bullet will lose *approximately* 2 fps per yard for the first few yards. You can apply this correction to the muzzle velocity input.

Atmosphere Inputs

The next input block is where all of the atmospheric data is input. The first input is the temperature in degrees Fahrenheit. The second input is atmospheric pressure, measured in inches of mercury. The third atmospheric input is relative humidity, measured in %. The relative humidity is the least important of the environmental inputs.
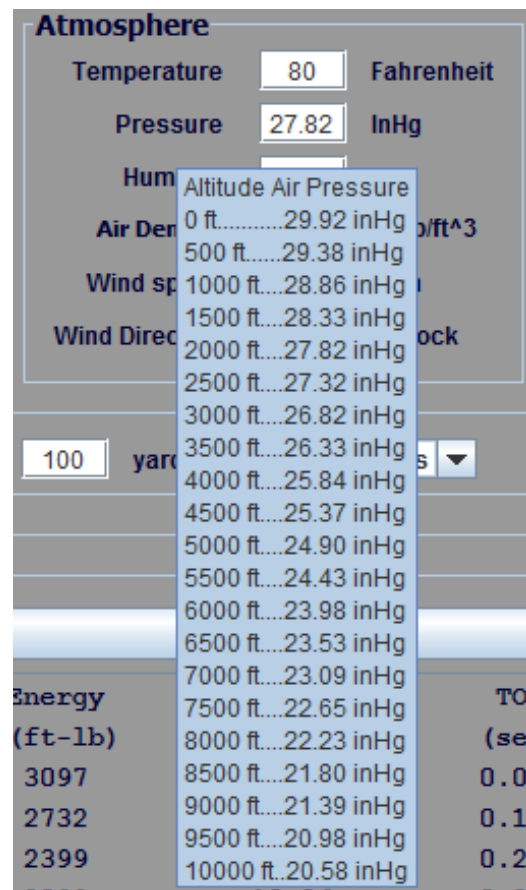
Following the humidity input, the program displays the air density that results from the given temperature, pressure and humidity. This output can be used to figure out the density altitude.

The final two inputs are wind speed (measured in miles per hour) and wind direction. The wind direction is input as a direction on the face of a clock, and is named for the direction for which the wind is blowing *from*. For example, a 12 O'clock wind is blowing directly in the shooters face, 3 O'clock is blowing from the right, etc. Using this program, it is not possible to calculate winds from a direction that is not a whole number on the face of a clock. In other words, if you wanted to calculate a wind from 10 degrees off the line of sight it's not possible because the numbers on a clock face are separated by 30 degrees. The reason it works this way is to simplify the input.

The atmospheric input that's most strongly related to altitude is the air pressure. For easy access to a table of air pressure at altitude, simply hold the mouse pointer over the word "Pressure", and a table will appear. The table gives atmospheric pressure in inches of mercury when the program is set for English, and millimeters of mercury when set to metric.

This program accounts for the vertical effect of a head or tail wind. This is a feature not found in many ballistics programs.
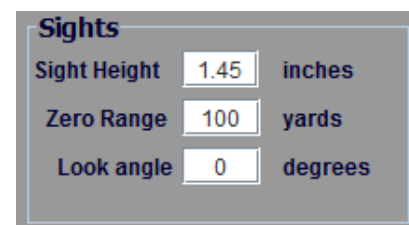
Inputs related to the sights

The next block of inputs is where you tell the program the essential information about your rifle's sights. The first input is the height of the scope centerline above the bore centerline in inches. This can be measured indirectly with calibers, and is important to the trajectory that's calculated.

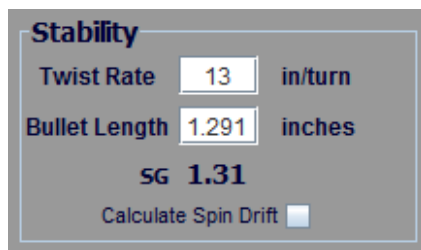The next input is the zero range in yards. Note that the

zero range has to be less than the max range (in the output options block) or the program will not run.

The final input is the look angle or *inclination* to the target. For look-up angles, this input is positive. For look down angles, insert a minus sign (-) in front of the angle. The program will adjust the effects of gravity for the look up/look down shot, but it will not account for the (smaller) effect of air density gradient. If the bullet traverses enough altitude on a look up/look down shot, it will encounter thinner or thicker air as it flies up or down in the atmosphere.   A formula and instructions for applying a correction for air density gradient is given in Chapter 4.

Stability Inputs

The stability inputs can be ignored without affecting the trajectory prediction. The stability block is there to allow a user to calculate the gyroscopic stability factor using the Miller stability formula. The stability calculation uses inputs from the bullet data input block including: caliber, bullet weight and velocity. The air temperature, air pressure, and relative humidity from the atmosphere input block is also used in the stability calculation. The remaining inputs required to calculate gyroscopic stability are bullet length and barrel twist, which are input in the Stability block. Chapter 10 discusses stability. Basically, you want to use a rifling twist that produces a stability factor of at least 1.3 or 1.4. This is an especially important consideration for long range shooting where the bullets tend to be long, and often require faster than standard twist rates.
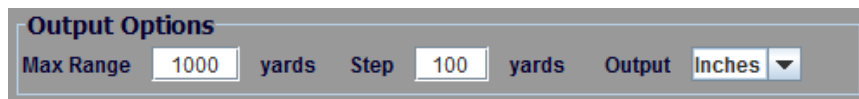

This ballistics program has the ability to calculate spin drift (gyroscopic drift) based on the gyroscopic stability and time of flight. If you have the proper barrel twist rate and bullet length input in the stability block, you can check the *calculate spin drift* box and the program will apply Equation 6.1 (the spin drift formula given in Chapter 6) and calculate the spin drift of the bullet which will be added to the wind deflection at each range. If you're interested in only the effects of spin drift, the easiest way to see it is to input zero wind speed. That way all of the horizontal deflection will be spin drift. The calculated spin drift will be positive, meaning to the right, which assumes the rifle barrel has a right hand (clockwise) rifling. If the barrel has left hand (counter-clockwise) riflings, the spin drift will be equal in magnitude, and opposite in direction.

Output Options

The final inputs deal with how you would like the outputs displayed. You can choose the maximum range and range increment in yards. The output window displays up to 11 lines of output at a time. Beyond that you have to scroll down to see the output. New for Version 2.0 is the option to
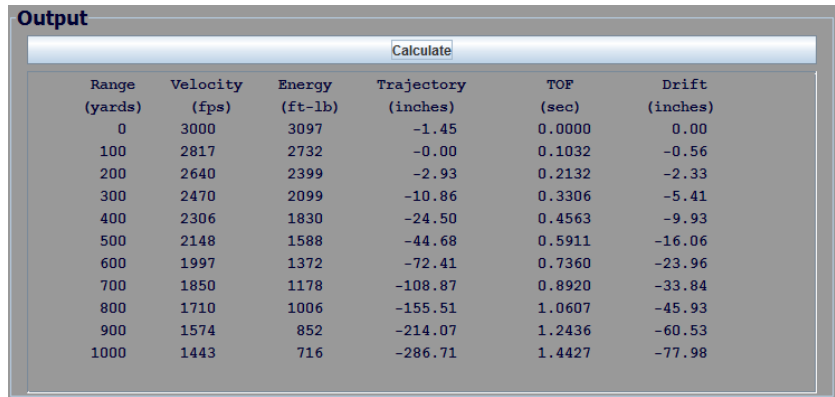

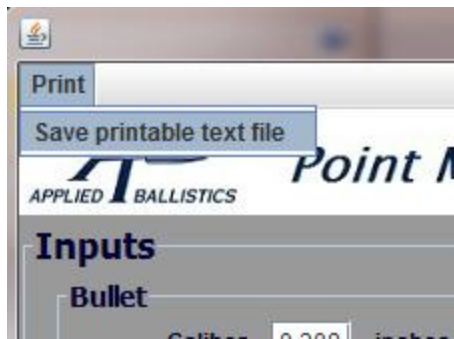output drop in various units including inches, centimeters, MOA, or MILS.

Program Output

In order to execute the program, click on the long **Calculate** button. The trajectory output will immediately appear in the window below. The available outputs are: velocity in feet per second, Kinetic Energy, bullet trajectory (in relation to the line of sight) in inches, time of flight in seconds, and horizontal drift (combination of wind and spin drift) in inches. Note: drift to the right is positive and drift to the left is negative.

Output

Calculate					
Range (yards)	Velocity (fps)	Energy (ft-lb)	Trajectory (inches)	TOF (sec)	Drift (inches)
0	3000	3097	-1.45	0.0000	0.00
100	2817	2732	-0.00	0.1032	-0.56
200	2640	2399	-2.93	0.2132	-2.33
300	2470	2099	-10.86	0.3306	-5.41
400	2306	1830	-24.50	0.4563	-9.93
500	2148	1588	-44.68	0.5911	-16.06
600	1997	1372	-72.41	0.7360	-23.96
700	1850	1178	-108.87	0.8920	-33.84
800	1710	1006	-155.51	1.0607	-45.93
900	1574	852	-214.07	1.2436	-60.53
1000	1443	716	-286.71	1.4427	-77.98

Version 2.0 of this software also has the ability to create a printer friendly text file of the inputs and outputs of the Point Mass Solver. By clicking on the print button in the top left corner of the program window, and selecting 'Save Printable Text File', you create a text file that automatically opens in any text reader (commonly MS Notepad).

Support

If you have any problems getting the program to run (after following the Java download instructions in the *Getting Started* section) please contact me at: Bryan.Litz@appliedballisticsLLC.com