Ballistics Trajectory Calculator 4.0

User Guide

This is a user guide dedicated to explaining the capabilities and the usage of the program.

A) Goal of the program

The main goal of the program is finding the angles for a trajectory, for which you can enter the distance, wind speeds, mass, area and starting velocity. After you enter the values, the program searches for the best angles corresponding to your trajectory, and if there are such angles, the program displays that and graphs out the trajectories. In the end the program will write out the data into a txt file.

B) Menu

The program is equipped with a menu to make entering and modifying the parameters easier. The menu looks the following:

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Main menu:
  1. I would like to give information about the position of my target.
  2. I would like to give information about the current wind.
  3. I would like to give information about the mass of the projectile.
  4. I would like to give information about the area of the projectile
  5. I would like to give information about the muzzle velocity of the cannon.
  6. I would like the program to begin the calculations.
  7. I would like to exit the program.
Please enter the number of your choice:
```

You can navigate the menu by entering the corresponding numbers.

C) Entering the parameters

You can enter the parameters of the trajectory by choosing options 1-5 from the menu.

1. **Target distance**: By choosing **1**, you can enter the distance to the target (in meters). The program will need this to calculate the angles with which the cannon can hit a target that far away. *This needs to be a number greater than 0!*
2. **Wind speeds**: By choosing **2**, you can enter the wind speed (in m/s). If there is no wind, you can enter 0, or skip this step – the program uses 0 wind speed as default. For tailwind, enter a positive, for headwind, a negative number.
3. **Projectile mass**: By choosing **3**, you can enter the mass of the projectile (in kg). *This needs to be a number greater than 0!*
4. **Cross-sectional area**: By choosing **4**, you can enter the cross-sectional area of the projectile (in m). Do note, the projectile is a spherical object. Due to air drag, large projectiles can only hit far away targets if they have enough mass and starting velocity. *This needs to be a number greater than 0!*
5. **Starting velocity**: By choosing **5**, you can enter the starting velocity of the cannon (in m/s). Larger velocities mean faster travel speed and further shooting range. *This needs to be a number greater than 0!*

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D) Launching the program

If you entered the necessary parameters, you can launch the program by choosing option **6**. If there are important parameters missing, the program will warn you about it. If everything is ready, the program asks for confirmation, then makes the necessary calculations.

E) Result

a) **Target reached**: If the target is not too far away for a trajectory with the given parameters, the program will graph out the trajectories and tell you the corresponding angles. Then the data will be written into a txt file. The program will return you to the menu, where you can either make other calculations (the parameters you entered before are still there, so for a second run you can choose to only change one parameter for instance.), or you can exit the program.

b) **Unable to reach target**: It can happen that with the given parameters there is no such trajectory that could reach the target. In this case the program tells you how far you can currently shoot with the current parameters, then returns you to the menu, where you can modify the parameters. Don't worry, you don't have to enter everything again. To reach the target you can either lower the target distance/area, increase the speed/mass, or change the wind.

F) Files

After a successful calculation, the program saves the data into a txt file. The location of the file will be the folder where the program is saved. It will be named *Ballistics.txt*. If you run the program for the first time or deleted/moved the file, the program will create a new one, otherwise it will append the results of the new calculation to the end of the existing file. This way you can have all the data from a series of calculations in one place.

G) Exiting the program

If you no longer wish to use the program, you can exit by choosing option **7** in the menu. The program asks for confirmation, then stops if you choose to exit.