

PROGRAM PTS-2DoF – PROJECTILE TRAJECTORY SIMULATION TWO DoF
– SHORT DESCRIPTION –

1. GENERAL INFORMATION ABOUT PROGRAM

Purpose and Possibility and Purpose of the Program

Program PTS-2DoF calculates basic quantities of ballistic or straight-line trajectory in vertical plane of various types of unguided and guided projectiles with and without rocket assistance. However, the main advantage of the Program is that it contains fifteen coded drag coefficients of various projectiles. Beside it is very simple for use. It is very useful for preliminary design and quick calculation of trajectory. Because program is simple and has good clear user interface.

Program can be applied on spin or fin stabilized projectiles such as: artillery classical projectiles, artillery rockets, mortar classical and rocket assist mines, anti tank projectile, aircraft bombs, rifle bullets.

Program PTS-2DoF was developed in VISUAL FORTRAN environment. Executable program version is completely autonomous. It is enough just to copy entire folder PTS-2DoF to your computer hard disc, and for the easier comfort work, to make shortcut of the file PTS-2DoF.exe on the desktop.

2. INPUT DATA AND PROGRAM CONTROL

Input file contains all necessary data for calculation. Program can be run using already prepared file, or in interactive mode, using program dialog. Upon successful run program automatically generates file with input data under the name Restart.dat.

To run the program do:

- Double click on shortcut or on the PTS-2DoF.exe file.
- Press button Open in the main menu to open one of the prepared files with input data in directory PTS-2DoF-DEMO\Examples, or enter data in edit fields.
- Press button Save. The input data will be saved in the program memory.

- Press the button Run. The input data will be saved in file Restart.dat and the program will calculate trajectory. Beside, the file Results.dat will be formed file with results of calculation.

View the file by pressing the button RESULTS.

Many possibilities of the program can be seen from main manu.

The screenshot shows the main window of the PTS-2DoF software, titled "Projectile Trajectory Simulation with Two Degrees of Freedom". The interface is organized into several sections:

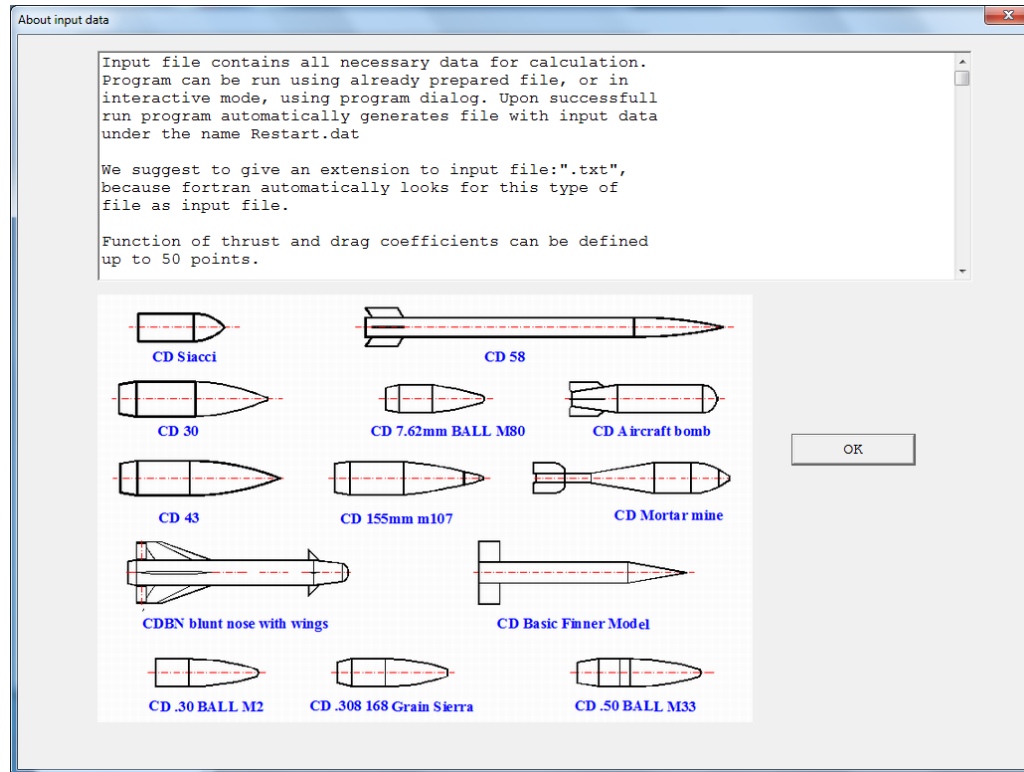
- Input:** A text field contains the file path "D:\C_ProSTools\PTS-2DoF-DEMO\Examples\SAM R10.txt" with an "OPEN" button next to it.
- Project information:** "Title" is "SAM R10" and "Description" is "Ballistic trajectory".
- Trajectory type:** Radio buttons for "Ballistic" (selected) and "Straight line".
- Initial conditions:**
 - Height [m]: 0.000
 - Mass [kg]: 125.0000
 - Velocity [m/s]: 0.0
 - Elevation [deg]: 45.000
 - Jump angle [deg]: 0.000
 - Altitude of traj. base [m]: 0.00
 - Launcher length [m]: 3.000
- Terminal conditions:**
 - Time [s]: 211.650
 - Range [m]: 100000.00
 - Min Velocity [m/s]: 0.000
 - Height_UP [m]: 10000.000
 - Height_DOWN [m]: 0.000
 - Trajectory apex
- Drag coefficient:**
 - Reference area [m²]: 0.02500000
 - Bullets etalons:**
 - Siacci - short nose without boat-tail
 - CD30 - long nose with tail contraction
 - CD43 - long nose with tail contraction
 - Rocket etalons:**
 - CD58 - sharp nose with wings
 - CDBN - blunt nose with wings
 - Air to surface rocket
 - Basic Finner Model
 - Standard projectiles:**
 - Bullet 7.62 BALL M80
 - Bullet .50 BALL M33
 - Bullet .30 BALL M2
 - Bullet .308 168 Grain Siera
 - Projectile 105 mm M1
 - Projectile 155 mm M107
 - Aircraft bomb
 - Mortar mine
 - Special shapes:**
 - Cube
 - Sphere
- Air condition on the MSL:**
 - Temperature [°C]: 15.0
 - Pressure [mbar]: 1013.2
- Time intervals:**
 - Integration step [s]: 0.0050
 - Printing step [s]: 5.0000
- Data about thrust:**
 - Thrust: On, Off
 - Specific impulse [Ns/kg]: 2250.000
 - Ignition time [s]: 0.0000
- Thrust vs time:**
 - Number of data: 5

Time	0.000	3.600	3.610	12.600	12.610
Thrust	23125.000	23125.000	4625.000	4625.000	0.000

 - Thrust correction coefficient: 1.000000
- User defined drag coefficient:**
 - Drag coefficient vs Mach number
 - Number of data:
 - Mach:
 - CD:
 - Drag correction coefficient: 1.000
- Help:**
 - PTS-2DoF
 - Input Data
 - Output Data
 - Help About
- Prog. controls:**
 - SAVE
 - RUN
 - END
 - Cancel
- Output files:**
 - RESULTS
 - RESTART
 - DIAGRAMS

Main window.

In the Help of the program there is short explanation of the input and output files. User can get information about input data by pressing button Input data.



Window about input data.

3. OUTPUT FILE AND GRAPHS

Content of output file Results.dat is as follows:

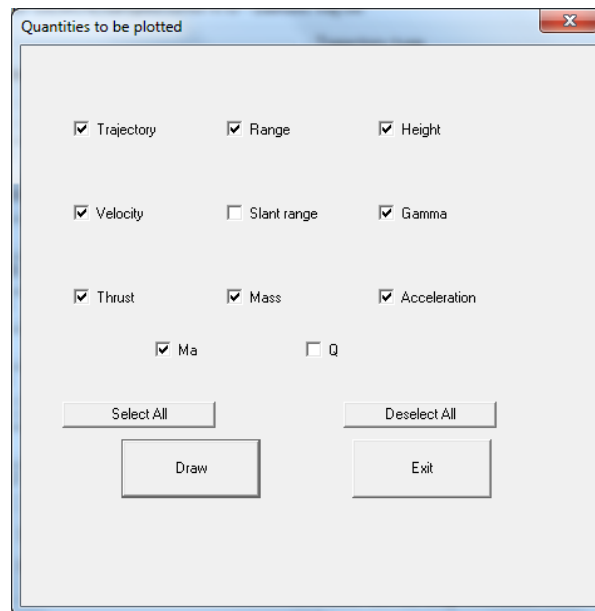
t[s]	- flight time
x[m]	- range
h[m]	- height
V[m/s]	- velocity
Gamma[deg]	- flight path angle
m[kg]	- mass
a[m/s ²]	- acceleration
F[N]	- thrust force
R[m]	- slant range
Ma[-]	- Mach number
Q[N/m ²]	- dynamic pressure

The quantities are written in column meter.

To draw diagrams do:

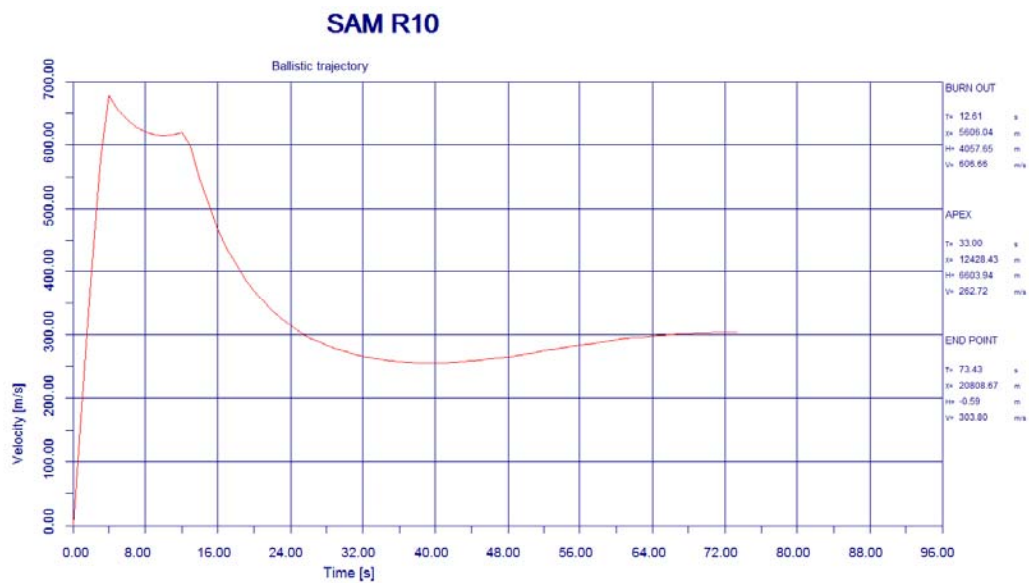
- Run the Program as it is explained.
- Press button DIAGRAMS.

- Select the diagrams to be drawn in window *Quantities to be drawn* and press button Draw then button Exit.
- In main menu press button END.
- In Window drop-down menu select the diagram to be shown.

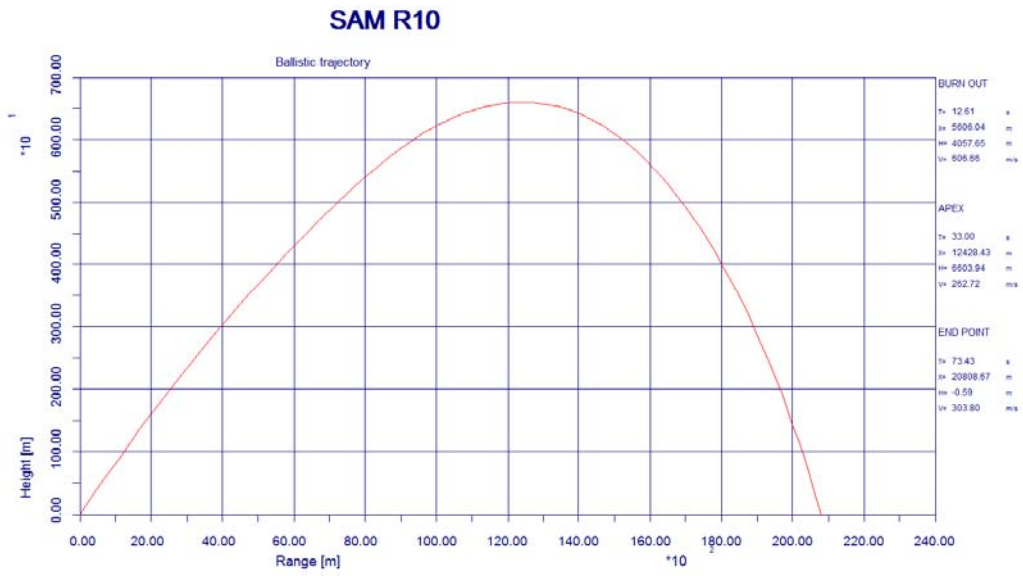


Window to select graph to be drawn.

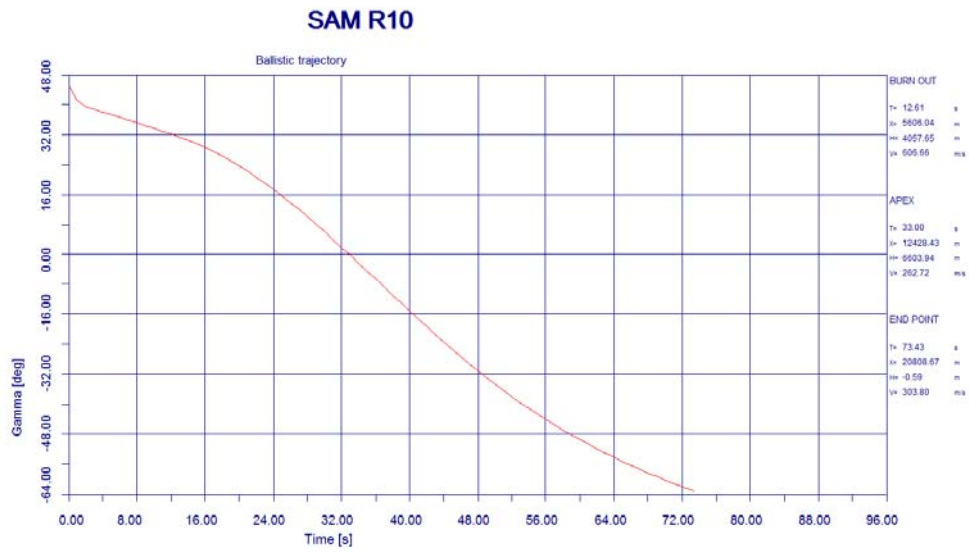
Here are some of the graphs obtained for a hypothetical missile.



Graph speed of flight vs. time.



Graph trajectory.



Graph path inclination angle.