Study Report

Practical study on Clay Target preliminary throwing speed in different altitude

Introduction:

Shotgun ranges have been constructed in different places in the world to be used for competitions and trainings. Based on ISSF rules and regulations, the targets must be thrown to special distance. For example in trap the target must be thrown to 76 meter +/- 1 meter. There is nothing about geographic specification such as altitude, humidity and ... in the ISSF regulations.

One of Physic's laws said: "In constant condition, the air pressure will be reduced by increasing the altitude."

There is a pretension about the speed of clay target in different altitude which is founded on the effect of air friction:

"In different altitude we have different air pressure and with different air pressure there is different air friction effect on the clay target and when we try to set the machine to thrown the target to same distance in low and high elevation range, we have to set the tension spring in different setting. In the other word the target which thrown to 76 meter in the range which is constructed for example in 1400 meter above the sea level has less preliminary speed to thrown to 76 meter than the target which thrown in the range which is in 70 meter above the sea level. The shooters who train in first range could not show his performance in second range. Finally there is no benefit to construct the ranges in high altitude to achieve the goals in world class shooting."

If this is correct:

- The average of speed for example in first 10 meter in the low altitude range should be more than high altitude range.
- Trap machine which set to thrown the target to specific distance in low altitude range with same setting will thrown the target more than that in high altitude range.

Studies:

We did below tests to find the answer:

The video analyze which was done in "Kuala Lumpur" and "Tehran"

Throwing (trajectory) path was captured by the video camera both in "Kuala Lumpur" and "Tehran" with the same setting (angle and elevation).

In both case the trap machine was set to thrown the target in 3.5 meter elevation and to 76 meter. The column ruler was placed in front of machine and the targets hit the column and were broken in both cases.
Conclusion:
After comparing the videos we couldn’t find any difference and it seem there is no significant difference in those cases.

Weakness:
The limitation of number of Frames per second in normal video camera (27 FPS) caused limitation in precision. We need to repeat the study with different method to be sure.

Study on throwing distance of "unique" machine with "unique" setting in different range.

- The DueMatic Machine was used.
  - This machine adjusted in SASAD Shooting club which is in Tehran.(1640 meter A.S.L)
    - Humidity, between 21 and 46 percent.
    - Temperature , 20 C
    - Air pressure, 845 Hpa
  - The machine was adjusted to thrown the target to 76 meter in 2.5 meter elevation.
    - 1 target was thrown one by one in each 1 second
    - The average of throwing distance was 76 meter. No target was landed before 57 meter.
  - The tension spring and elevation screw was sealed and the machine prepared to Transfer to "Bandar Anzali"

- "Bandar Anzali" is a port-city placed in north of IRAN.
  - The shooting range altitude is 12 meter below sea level.
  - Air pressure, 1016 Hpa
  - Temperature, 19 C
  - Humidity, between 61 to 93 percent
  - The machine setting was controlled and no changes were founded.
  - 1 target was thrown one by one in each 1 second
  - The average of throwing distance was 77 meter.
  - No target was landed before 76 meter

For more precise the study was done again in reverse order. In this step the machine was set in "Bandar Anzali" to throw the target to 76 meter
  - 1 target was thrown one by one in each 1 second
  - Temperature, 16 C
  - The average of throwing distance was 76 meter.
  - No target was landed before 75 meter
  - Trap Machine sealed and prepared to transfer to Tehran Again.

- The shooting range altitude in Tehran is 1640 meter above sea level.
  - Air pressure, 843 Hpa
  - Temperature, 24 C
  - Humidity, between 17 to 41 percent
  - 1 target was thrown one by one in each 1 second
  - The average of throwing distance was 75 meter.
  - Target was landed before 75 meter (77, 71)
Conclusion:
By the result of correlation test, the pretension is not approved.
This study approve the result of video analyze test.

1. We could not talk about relation of air friction and altitude. That’s not clear question. The dependency of air friction effect to a large number of different parameter force to talk about it with more carefulness. We have to compare two different ranges by comparing all parameter in same time. Air pressure and air viscosity is two different parameters which related to each other. There are other parameters such as humidity, temperature, trajectory speed, Gravity and … which could change the air viscosity. To evaluate the air friction effect on the clay target we have to pay attention to all parameter in same time. Normally, and in most cases the effects of humidity in world cup ranges on trajectory speed are more important than the altitude.

2. Air friction is fully related to speed square of trajectories. And Clay target is a low speed trajectory. If in some cases it could be correct, how much difference we could find? In the other word is it important? For example if the preliminary speed of clay target will be changed 1 or 2 m/s, is it useful to focus on it? In some competitions wind speed is more than that and the shooter, who was trained to shot with good technique, could cover it.

3. Don’t forget, the diameter of pellet pattern will cover some changes.

Weakness:
Other parameter such as humidity and … must be controlled to increase the precision of study.

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1The conclusion is only talk about comparison the preliminary speed of target in "SASAD" and "Bandar Anzali". Till now we could not generalize it before gathering more data.