Efficiency Assessment of Variables for targeting water rocket with precision.
- For a international competition as a member of JAXA national team -

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1 Background
Flying objects have amazingly diverse designs. We think they have every reason for the each design. Last year We participated in an international water PET bottle rocket contest where we compete the accuracy of the control to hit a target. We were interested in how accurate we can control a PET bottle rocket. We designed with three 1.5 litter PET bottles. We figured out that the balance between projected area and weight center were crucial for the stability of the rocket. Furthermore, the air pressure was the easiest variable to control the flying distance.

2 Method
2-1 Projected Area
Because of the lateral face of the rocket receives air pressure during the flight, the width of projection area of the rocket affects the lifting power of the rocket. We controlled the projection area with the number of the PET bottles that we used. For the final model, we vertically jointed maximum 3 PET bottles to keep large projection area. In addition to that, we tested the flights with or without a nose cone, to inspect the nose cone efficiency for the.

2-2 Balance
We controlled the balance of the body by controlling the amount of water and the weight. We repeated experiment changing the position of the weight, either if we are putting on the tip or in the middle.

2-3 Flying Distance
We controlled the flying distance by adjusting the amount of water and the amount of pressure we put. The former affects the duration of the lasting propelling power, and the latter affects the propelling power itself.

2-4 Evaluation
We first set a target distance as 50m and measured the distance between the hit point and the target in various wind conditions. Then we changed the target distance to 60m, 70m and examined if the stability and accuracy also reproduces in the condition.

3 Results and Conclusion
Through this study, we have found out that a longer body with bigger projected area is better for controlling the accuracy and stability. In addition, adding an angle of the fin can stabilize the flight, however too much angle increased the air resistance and made the flying distance shorter. The most effective variable to control the flying distance was the air pressure.