

Joseph Van Amberg

Wellington Jet  
Flow Visualization  
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## Introduction

The purpose of this project was to visualize a drop of water impacting a still surface of water, and to observe the effects. The phenomenon captured in this image is known as a Worthington Jet.

## Body

The flow seen in the image is known as the Worthington Jet. It was captured by dropping a single drop of liquid on to a still surface of liquid. Initially, when the droplet hits the surface, inertial and viscous forces cause the droplet to spread out. As the droplet spreads out it, begins to slow due to viscous forces and surface tension, and forms what is known as a crown. When the crown collapses and the liquid falls back into the crater created from initial impact, a jet of water is thrust upward to create the phenomenon known as the Worthington Jet. The Jet in this image is approximately one inch high. The droplet had an estimated speed of 4.2 m/s when it hit the surface of the liquid. The camera speed was fast enough that the image is basically a still shot of the image.

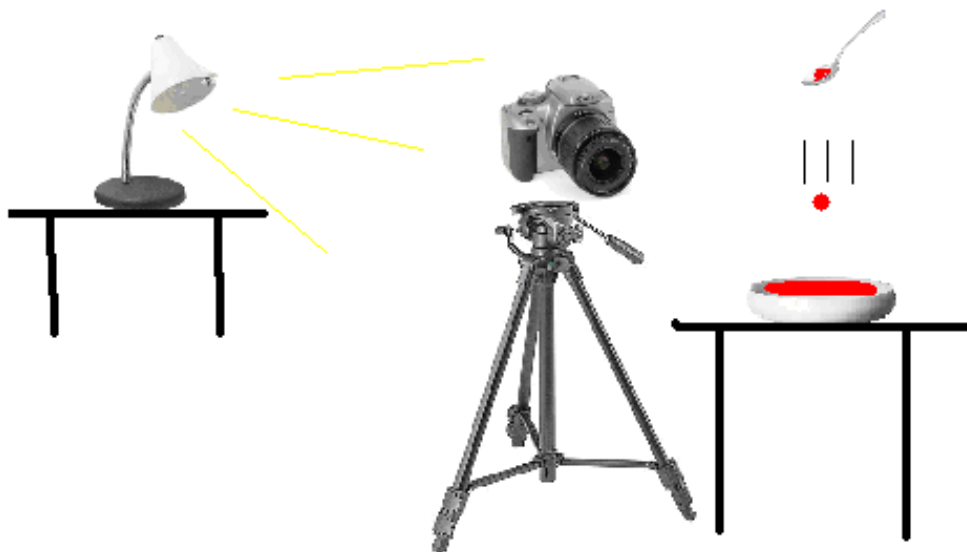


Figure 1. Schematic

In order to capture this image, a large bowl, approximately a foot and a half in diameter, was filled up with orange Gatorade and a drop of Gatorade was dropped off the edge of a spoon from approximately three feet above the bowl and impacted the surface of the Gatorade. The camera was set up on a tripod approximately one foot away from the bowl. The lighting used was a desk lamp with a CFL bulb positioned behind the camera. There flash from the camera was not used.

### **Technique**

The field of view in this image is approximately seven inches across and five inches high. The distance from the object to the camera lens was approximately one foot. The focal length of the lens was 55 mm. The camera used was a digital Cannon EOS Digital Rebel XT. The initial pixel height was 2,298 pixels. The initial pixel width was 3,456 pixels. The final pixel height was 1,980 pixels. The final pixel width was 2,730 pixels. The aperture was set to f/6.3. The shutter speed was set to 1/400<sup>th</sup> of a second. The ISO was set to 400. The original image was edited using Photoshop. The curves function was used to bring out the colors in the image. The clonestamp function was also used to take out some light reflecting in the water. Finally, the image was cropped to center the flow.

### **Conclusion**

The image reveals the phenomenon known as a Worthington Jet. I really like the way that the Worthington Jet looks in the image. I suppose there could have been a bit more focus. The fluid physics are portrayed very well in the image. The Jet is very clear and distinct, and the ripples in the water are prominent. I feel as though I did fulfill my intent with this image. I would like to improve the colors in the image. I think that more, or different colors could make it much more intriguing. In order to develop this idea further, I think that it would be cool to have two of the Worthington Jets occurring side by side. This would be pretty difficult to create and capture though.

### **References**

[http://www.ecs.umass.edu/mie/faculty/rothstein/pub\\_files/JNNFM2005v125p1123.pdf](http://www.ecs.umass.edu/mie/faculty/rothstein/pub_files/JNNFM2005v125p1123.pdf)