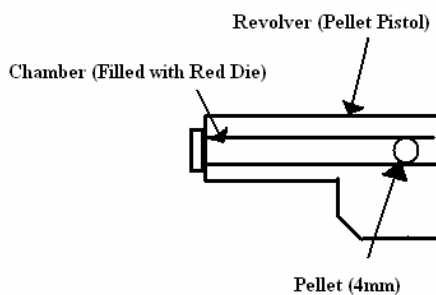


The purpose of this image was to artistically represent the behavior that exists when an air pistol is fired. We used a die to illustrate the path of a projectile and the trailing gasses. The original goal of the image was to capture a path of bubbles exiting the barrel of the air pistol. In some of our first attempts we used two different firearms to represent the phenomenon. We were fortunate enough to capture a vortex ring that developed during the photograph.

We were able to create our image by using an Airsoft air pistol (figure 1). The air pistol uses springs and compressed air to shoot out a pellet at high velocities. To slow the fluid phenomena that was occurring, we used a tank of water to help capture the image.



We filled the chamber of the air pistol with a red die to help give effect. With the air pistol cocked and loaded with a 4mm pellet, it was submerged under the tank of water and fired. The field of view for this image was approximately 8 inches by 1.5 inches. In this image, the pellet has already left the field of view. There are three noticeable fluid phenomena that occur in the image. Most noticeable is the vortex that was most likely created by the frictional boundary of the pellet on the water,

dragging the water over the surface of the pellet. There is a small air ring within the vortex and a layer of die on the outer part of the vortex. The air ring that occurred is due to a lower pressure that happens within the ring, keeping the air where the lower density is. The Reynolds number for the vortex is large, >5000 . This is clear due to the turbulent surfaces around the air in the ring. There is also the thin jet of bubbles that followed the pellet. This jet passes through the vortex. Closest to the air pistol is a cloud of air. This is the majority of the air that was in the chamber before being fired. After being fired, it moved slower out of the chamber than the pellet did. Notice on the collection of air that there is one primary cloud towards the left of the mass. To the right, there are small collections of air that is trailing.

The visualization techniques that we utilized in our photograph were boundary marking and particle tracking. A die was used to represent the velocity of the water that exited the barrel of the air pistol. This die also traced the path of the projectile. The particle tracking found in our photograph was due to the bubbles that are found in the wake of the fluid. The lighting technique that was used in our photograph was direct sunlight. Using the sun with approximately sixty degrees from the vertical axis of the fish tank we were able to adequately light the flow without creating a distracting glare. No flash was utilized in the creation of this photograph.

The camera used was a Pentax ZX-5N with a 28mm to 200mm lens set at about 75mm and the shutter speed was set at 1/2000th of a second with an aperture of f/5.6 and the film used was 400speed Fuji Superia X-tra. The camera was mounted on a tripod with the subject approximately three feet away resulting in a field of view of about fifteen inches by ten inches.

The image chosen features a vortex which is a direct byproduct of the pellet fired from an air pistol. The air that follows the pellet out of the barrel occasionally formed the vortex as shown in the image. What is unique about the photo is the trail of the pellet that can be seen as the stream of bubbles that seemingly splits down the center of the vortex.

The image featured was originally thought to be near impossible to capture. During the photo session, the attempts to create the desired underwater bubble effects seemed dismal. From just a general inspection of the fluid flow, it was assumed that a second method would have to be thought of to capture the desired image. On the contrary, the images came out to be quite exhilarating. The initial perspective during the photograph session gave an ominous feel to the end result; however, the zoom of the camera captured an entirely different image than was expected. This is what is luring about this photograph. One negative aspect of the image is that it was taken using a standard film camera. The scan of the image turned out to require more work with the end resolution being below standard digital.

As described before, the original intent of the image was looked upon as a failure previous the development of the images. After the images were processed the desired intent was dramatically realized through many of the photographs. Only one is presented here. Improvements can be made upon the equipment used to take the photograph. The use of a digital camera would eliminate the scratch mark and fuzz that had to be removed from the image using Adobe Photoshop. Other improvements lie in the air pistol itself. Minimizing leaks would prevent the air from escaping before the air pistol is shot contributing to the bubbling effect desired.

Image of how we took our photos!

