EVOLUTION OF THE AVALAUNCHER

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ABSTRACT: The Avalauncher has been an integral tool for avalanche mitigation work for close to 50 years. With their ability to place a kilogram of high explosives up to two thousand meters away, they routinely serve as a short range alternative to military artillery. The Avalauncher's roots can be traced to a pneumatic baseball pitching machine used by Major League Baseball teams in the United States in the late 1950s. Throughout the decades, many modifications have been made to both the launcher and its projectiles. Current technology has allowed the Avalauncher to attain greater accuracies and operational range. In this paper I plan to cover not only the history of the Avalauncher but also explore its potential future.

KEYWORDS: Avalauncher, avalanche mitigation, avalanche control.

1. PAST

OK, I'll admit it: I've always been a big Monty Atwater fan. Not only is the man credited with being the father of modern avalanche forecasting and safety in the United States, but he is also responsible for developing the Avalauncher. Through its more than 40-year history, the Avalauncher has gone through many changes yet continues to prove its worth in avalanche mitigation work. After Atwater's stint in the 10th Mountain Division in World War II, he took his skills to Alta, Utah in 1945. It was there that Atwater began applying a practical approach to both studying and mitigating the effects of avalanches. In 1951 Atwater was able to bring artillery into the picture. Almost as soon as the military weaponry began their assault on the Little Cottonwood Valley did the murmurings of the imminent obsolescence of both the guns and their warheads begin.

Figure 1. Monty Atwater demonstrating the original Mark 10 Avalauncher at Squaw Valley, California in 1962. Photo courtesy of Monty Atwater jr.

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While Atwater experimented with a variety of alternatives, each had their drawbacks. In the summer of 1961 one of Atwater's supervisors showed him some product literature of a pneumatic baseball pitching machine. The wheels began turning and after several conversations with the machine's inventor, Atwater was able to view a demonstration of the first Avalauncher late that same year.

Frank Parsoneault was the genius behind both the pitching machine and the Avalauncher. His full time job was as a fixtures engineer for Douglas Aircraft but on the side he was an inventor. What made both machines work was a valve that would allow for the almost instantaneous release of compressed gas. By the late 1950s, many Major League teams were using Parsoneault's "Fireball" pitching machine.

While the pitching machine received a patent, the valve assembly itself did not. Soon the valve was copied for many different industrial applications. Today, derivations of the Parsoneault valve are used in air cannons to blast clogging and

caking from railway car hoppers, kilns, silos, power stations, and cement works. In these applications, large quantities of compressed air are sufficiently forceful to remove material obstructions from the equipment to which they are attached.

Figure 2. Frank Parsoneault in the early 1960 with some prototype projectiles. Photo courtesy of Ed LaChapelle

There are roughly 200 Avalaunchers being used throughout the world today. The first production model was the Mark 10 and it sold for $500. Atwater and Parsoneault's sales strategy was to sell the guns at their cost then make their meager profits off the projectiles. Sales for the first launchers began prior to the 1962/3 season. Originally monikered a "400 yard Launcher," the Mark 10 was quickly superseded by higher-pressured, longing-ranging units. Early projectiles, if they could even be referred to as that, were simply a few one-pound cast shots taped together. Conveniently, their three-inch diameter mated precisely enough with the standard sized aluminum pipe that formed the barrel. The rounds were lit, dropped down the barrel and the fire valve was released.

It doesn't take a rocket scientist to realize there were drawbacks to this projectile. Aside from the glaring safety issues associated with a shot burning in the barrel, the flight characteristics were poor. Fin stabilized rockets soon followed. Their fusing systems saw a short piece of safety fuse coupling a detonator to the old-style t-handled pull wire igniter. The t-handle, which was just an old piece of out-dated fuse, was removed and the remaining wire passed through a hole in the projectile's base plate. The igniter wire was then tied off to a fixture on the gun. This way, when the gun was fired it would begin the ignition sequence.

Figure 3. An early projectile system using Nitromon, safety fuse and a pull wire igniter. Photo courtesy of Paul Hauk.

It was an idea that looked good on paper but also one that lead to several accidents. In April of 1966 two United States Forest Service (USFS) workers lost their ear drums when an in-bore pre-detonation occurred at Tuckerman's Ravine. In September of the same year, three gunners were killed by a similar accident in the Rio Blanco mine in Chile. In both accidents small amounts of escaping gas proved forceful enough to move the projectiles far enough up the barrels to ignite them but not forceful enough to eject them completely. While work on an impact fuzing system had begun in the mid 60s, these accidents now saw that system though to fruition.

The idea behind the earliest impact fuzing system was to have a firing pin, which was held in place by a magnet, be driven into a shotgun shell's 209 primer when the rocket hit the ground. A 209 primer is made up of a pellet containing lead styphnate – the same compound found in the ignition mixture of most blasting caps. When the firing pin hit the 209, the energy of detonation would be driven into the open end of a blasting cap.

An accident occurred with this system when Atwater was demonstrating a launcher in 1968 at the Idarado mine in Colorado. At this time the magnets being used were donut shaped because this design held their magnetism better. Apparently the hole in the old style base plate lined up with the magnet hole and when the gas was released it was able to drive the firing pin

forward. A gunner was killed and Atwater lost hearing in one ear.

This accident caused the development of the flight safety system and the use of solid magnets and base plates. In this system, a spring loaded pin sits in front of the firing pin. The basic logic behind this safety feature was that the firing pin would only be able to travel towards the 209 primer once the shot was approximately 50 yards from the barrel.

There is one application where the flight safety system is *not* used, because the target is so close to the barrel. This need arises inside mines, where transfer tunnels are bored between mining floors in order to transport ore. When these six-foot diameter holes become clogged, the easiest way to unplug then is with an Avalauncher shot. In this situation, the firing is done remotely.

From the first fin-stabilized rockets in the early 60s and continuing through the early 70s, projectiles at this time used explosive products designed to be lowered into oil wells. These products, called "perforators" within the industry, were sturdy units built to withstand the extreme pressures found deep within the wells. Ammonium nitrate and TNT oil formed the explosive that were packaged within steel cans. Not only could several of these cans be screwed together, but they had a nose cone that could be screwed onto the top of the can. Parsoneault made dies for stamping out aluminum tail fins and Atwater assembled these together at his home.

In an attempt to find a replacement for artillery, the USFS began accepting contract bids for alternative systems in the early 70s. In addition to the Avalauncher, the Bermite Corporation's RAMP system (Rocket Assisted Military Projectile) sought the USFS contract and Honeywell pitched their 57 mm recoilless rifle that could fire a plastic-cased warhead. Even though the Avalauncher was being used extensively, RAMPS got the contract. This weapon used a 40 mm mortar cartridge to launch the rocket and then an onboard propulsion system kicked in. RAMPS unfortunately were never able to deliver a viable product. The Forest Service was not only disappointed but also out the contract money. Another contract was never offered.

An interesting woman in the history of the Avalauncher was Jerry Nunn. Jerry began patrolling at age 18 at Donner Pass, California. Despite having seven children by age 30, Jerry continued to patrol. In 1957 she began working at Squaw and when the Olympics came in 1960, she worked with Atwater doing avalanche control. She originally met Atwater in 1957 when she went to Alta for the U.S. Forest Service's Snow Ranger course. Almost blocked from the course because she was a woman, Jerry went on to become the country's first female snow ranger. Over the years, Jerry was credited with selling close to 30 Avalauncher. She was also responsible for introducing Pete Peters to Atwater in 1973.

Figure 4. Jerry and Monty in 1974 with an MK 16 launcher. The projectile utilized three cast primers, each weighing 350 grams. Photo courtesy of Pete Peters.

Shortly after their introduction, Atwater partnered up with Peters and together they formed Avalanche Control Systems. Peters promptly put $16,000 into the company so that plastic molds could be purchased to manufacturer the next generation of the tail fins and rockets. In 1976 Atwater passed away after a heart attack. He was 72 years old. Peters took control of the company and continues to manufacture and sell the projectiles. In the late 80s Peters quit building the guns and it was at this point that their prices began to skyrocket.

Currently there are four commercial producers of Avalauncher in the world with another company making a similar product. Of the launchers, the US-made weapon of the Launcher

Company sells for $15,000, Avalanche Mitigation Services' for $9850, the Canadian SEAR's gun for about $17,000 and the French launcher for around $30,000 (all figures US dollars). For comparison, Peters sold his last guns for under $1200. While the US and Canadian gun are both designed for Avalanche Control System's 82.55 millimeter shell, the French Launcher shoots an 83 mm round that is almost six feet in length. In addition to its pricy gun cost, the French Launcher charges $170 for its projectile. Its binary explosive, which is mandated to become inert within a short time period, drives the total shot cost up even more.

Another gun that deserves mention here is the LOCAT. This is a compressed gas weapon that operates up to 3000 pounds per square inch (psi) - compared to the 400-450 psi max pressures of the previously mentioned Avalaunchers. The higher pressure not only allows greater range but also the ability to use a military style detonator. The LOCAT price tag is a staggering $190,000. Reserved for only those with the deepest pockets, LOCAT ironically stands for Low Cost Artillery Trainer.

With their ability to place several pounds of high explosives up to two thousand yards away, the Avalauncher continues to be a viable tool for avalanche mitigation work today. Its effectiveness is owed to the hard work and foresight of many men and women, not all of whom have been mentioned.

2. Present

As a result of the research that went into this article, Avalanche Mitigation Services was incorporated. Aside from the company's consulting branch, the Falcon GT Avalauncher is our first product.

The Falcon GT Avalauncher is a breech loading tool designed to utilize all the current projectile systems. Several innovations not only afford the user increased accuracy and shot repeatability but also increased safety. The launcher is built on a 650 millimeter base bearing. Three toggle clamps quickly lock to prevent the launcher from rotating. A 360 degree azimuth ring is engraved onto the base bearing plate, allowing easy indexing of targets. A snap pin retainer allows rapid and secure elevation changes. The projectile is locked into the Avalauncher by simply rotating the breech plug 45 degrees. Lastly, the launcher is supplied with the firing valves at the end of almost 6 meters of pneaumatic line for remote firing behind blast shields.

Figure 5. Falcon GT Avalauncher.

Several projectile systems are under development. Just as projectiles used pre-cast shots in the early 1970s, Avalanche Mitigation Services has built an adapter plug which will allow projectiles to use pre-cast shots again today. The energy of the firing primer is simply directed into a relocated blasting cap well.

The Falcon RT 450 projectile will use either one, two or three 450 gram cast explosives. The Falcon RT 350 projectile will use either three or four 350 gram shots. For more information see: www.avalanchemitigationservices.com

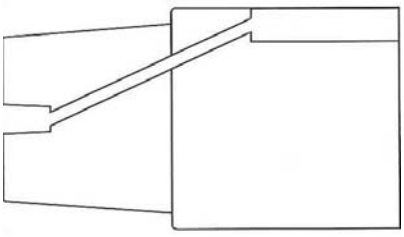

Figure 6. Energy Transfer System (ETS) adapter.

3. ACKNOWLEDGEMENTS

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