RATTAC TECHNOLOGIES PRESENTS:

WEAPON SHIELD

THE "BLACK PAPER"

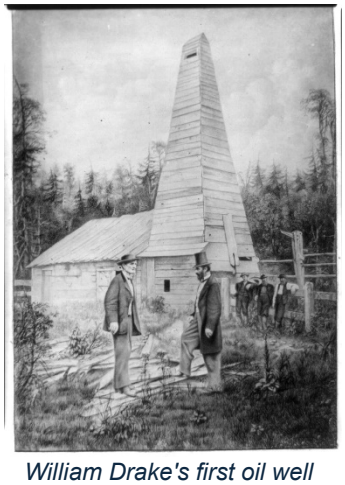
The History,
the Science,
Rattac Technologies, and
Why Weapon Shield™ is Better

Contents

The History

The story of Weapon Shield™ cannot be told without referencing the history of the development of lubrication science in Pennsylvania.

Butler County, PA where Weapon Shield's history begins has developed a combination of a hard-working blue-collar traditions, and strong family values found uniquely in western Pennsylvania – best known as steel country. The city of Butler just north of Pittsburgh, is a central hub of historic manufacturing, scientific development, and industrial innovation. Home to the development of the Jeep that carried our servicemen through WWII and became a worldwide phenomenon. It is also home to the production of the Pullman rail cars that carried people, and cargo that kept America ticking.



William Drake's first oil well

Pittsburgh area innovators brought us things like the Ferris Wheel, the pencil eraser, the movie theater, the gas station, the revolving door, the sneeze guard, soda pop, the toilet paper roll, Heinz Ketchup, the world's first commercial radio station (KDKA), the first kidney transplant, and the smiley face emoticon. But what ties the Pittsburgh area innovation to this story is the drilling of the first oil well in Titusville, PA just a quick drive north. William Drake had brought crude oil to the world just in time to cool and lubricate the machinery of the industrial revolution. Titusville was just the beginning. Pennsylvanians chasing the black gold formed towns that remain today like Pithole, Petrolia, and Oil City. Even Rattac CEO's hometown of Evans City was an oil boomtown.

Much has happened to the lubrication industry since then. As you can imagine a great deal of that innovation took place in Pennsylvania. Quaker State motor oil, Pennzoil, Wolf's Head to name just three, once boasted production of over 60% of all motor oil sold in the U.S. PA produced perhaps a dozen more oil companies at that time. "Pennsylvania crude" became a selling point for oil companies and customers came to expect that slogan on cans and bottles as a sign of quality.

Evans City, PA 1915

For this reason, it's no surprise that the breakthrough in boundary film lubrication world be developed here as well. This work in the lubrication field broke new ground in the science of tribology. What was theory was now practical science and the flood gate to advancement was now open. First Muscle Products Corporation was used to further the study and development of these advancements. Then came Steel Shield Technology of Bethel Park, PA.

The Science

Steel Shield introduced the world to Weapon Shield™ and Advanced Boundary Film Technology or ABF. In 1985, Dr. George Fennell, a former scientist in the field of Astronomy and Astrophysics was doing consulting and contract work in advanced lubrication and surface Tribology. The technology he discovered stems from the science of Tribology through Electrochemical Ionization (ECI) by treating the metal not the oil to reduce friction coefficients between two metal surfaces moving in the opposite direction.

Through these efforts Dr. Fennell formulated a revolutionary metal treatment and oil additive which can activate ABF lubrication methods through a proprietary and unique “electro-chemical ionization” (ECI) process (more on that in George’s paper which follows). Dr. Fennell has since been known in the industry as the “Father of Advanced Boundary Film Lubrication” and halogenation without corrosion.

Based on ABF, a series of specialty lubricants were derived to meet the specific requirements of various industries, which so far to date, are the most advanced formulas in lubrication and lubrication theory. In reality, the nearly half a century of research and development embodies the relentless pursuit of several generations of scientists from theory to reality of the products George created.

Over the years, since the official launch of ABF products in the marketplace, there have been numerous aftermarket products trying to replicate Weapon Shield™ (and other ABF products), but due to its unique formula and advanced chemistries, none have been found to even come close to duplicating the results. To this date, Dr. Fennell is still the leader and top expert in this field.

The sole purpose of Dr. Fennell’s legacy is to manufacture premier quality metal treatments, additives, greases and lubricant oils that have been tested to exceed customer expectations. ABF products like Weapon Shield™:

- Increase lubrication under extreme pressure.
- Create anti-wear properties that increase under heat and pressure.
- Create unsurpassed protection against corrosion saving on maintenance costs.
- Reduce downtime.
- Reduce energy consumption under operating conditions.
- Improve overall functionality of your products.

Enter Rattac Technologies, LLC.

Weapon Shield™ products are now produced by Rattac Technologies, LLC. which is currently located in Tenino, WA. Rattac had a short-lived venture marketing high quality broach-cut stainless steel true National Match grade pistol barrels for Glocks and Sigs in the early 2000’s. These barrels had an excellent open market reputation and served their community well with quality product and excellent customer service. A professional review by one of YouTube’s most respected firearms influencer channels, the Military Arms Channel, covered the Rattac barrels HERE and gives them an honest review. As of this date that video has been viewed 1.45 million times. This early Rattac venture was cut short due to family issues and supply chain problems, but the name and the product made a solid impact on the firearms community as a product and company seeking excellence.

Rattac was resurrected in February of 2023 as the vehicle for the reintroduction of Weapon Shield™ products and expansion into support and training segments yet to be introduced.

Rattac is a portmanteau formed by combining Rattler and Tactical. “Rattler” was the callsign of A Co. 3/47th Infantry Regiment (Motorized) that the founder and CEO Tom Spithaler served with for a large portion of his service in the U.S. Army Infantry.

The 47th Infantry Regiment is a storied unit that is battle worn from WWI through to today. The 47th landed on Utah Beach on D-Day, was the unit that liberated St. Lo (made famous in the film “The Longest Day”), fought in Roetgen, the Hertgen Forest, was among the first to penetrate the impenetrable Seigfried Line, was the first to liberate a German city, served in the relief of the 101st at the Battle of the Bulge under Gen. George Patton, and was the first enemy unit in all history to cross the Rhine River (into Nazi Germany) under arms – at the Remagan Bridge.

The 47th has received 9 Presidential Unit Citations and 4 valorous unit Awards for their service to the United States and Allied nations. Tom’s stint with 3/47 culminated in a deployment to Desert Storm in 1991 serving under the 18th Airborne Corp and the 82nd Airborne Division.

Unit Crest of the 47th Infantry Regiment

Around 2017 Dr. Fennell began to step back from overseeing the day-to-day operations of his company Steel Shield Technology. At that time, he looked to his CEO, Mark Pushnick to handle the continued growth and development of the company while George spent time with his family. Sadly, the opposite happened, and soon Mark was unable to answer for financial shortfalls. With assets depleted and debt rising, when Covid hit us all in 2020, Steel Shield Technologies did not have the cash reserves to continue operation. With debt looming, the business ceased operations and the bank took control of the remaining assets. George was the sole Board Member left to absorb the loss.

In the fall of 2022 George reached out to his longtime friend, industry associate, Tom Spithaler to field his interest in purchasing Weapon Shield™.

Tom as we know is a Combat Infantry Veteran, was a U.S. Army Trained Armorer on all infantry weapon’s platforms. Additionally, Tom served for 23 years as the Sales and Marketing Director for Olympic Arms, Inc., at the time one of the top three AR15 manufacturers in the country. While with Olympic, Tom also served as a Steel Shield Technologies outside Sales Representative.

The interest was there and by February of 2023 the deal was struck. Weapon Shield™, the formulas and all intellectual properties were purchased by Tom Spithaler and Rattac Technologies was reborn.

Rattac is now the sole producer of George’s formulated Weapon Shield™ products worldwide. If product does not have a Rattac logo on it, it’s NOT George’s formula. It’s simply a cheap imitation seeking to profit from Georghe’s legacy. Do us a favor, if you see counterfeit product, let us know, and don’t buy it

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Why We're Better

Full disclosure - there are a lot of lubricants on the market in the firearms industry. Many claims are made by those brands as well. Some claim to be “military grade” (whatever that is), some claim to be the #1 lubricant (but never explain how or what they’re #1 of – sales? Quality?). Some look just like specialty auto lubricants that have been repackaged and rebranded (for good reason). If you follow the firearms lubricant industry, you probably remember some brands testing identically to repackaged “Crisco Oil”. Some have flashy colors like purple or red and smell like 30 weight oil or transmission fluid. Again, they just might be. Some claim to be the ‘oldest’, the ‘longest running’ or ‘most recognized’ brands. Some heritage brands have been around as long as most of us have been alive, and people buy them simply because of brand recognition. Put a popular firearms brand name on a bottle of oil and regardless of tests, ingredients, or results, they are regarded as “quality”. But good enough, right? They are there, people are clearly using them and are for the most part satisfied.

Let’s be honest, any gun lubricant on the shelf today will lubricate your firearms, and probably make them function better for a short period of time. What makes Weapon Shield™ is not that it has a better base oil, or that it has “X” viscosity, or its color or where it’s made – and most especially not because it’s popular. What makes it better is science.

The science that makes Weapon Shield a superior product for firearms applications is contained in microscopic detail beyond most non-scientists in the “Boundary Film Lubrication Through Advanced Halogenation Techniques” paper that George authored years ago that follows this portion of the paper. My job here is attempt to make that science make sense to the average user.

I. Base Types: Let me expound on some the average categories of lubricants used on firearms and then we can address the pros and cons of each. While each lubricant could be categorized in several different ways, the most likely way to see them differentiated is by their base. Each lubricant has a ‘base’, and that base oil is the primary product through which all the other ingredients cooperate to create the effect of lubrication. About 99% of these base oils can be put in one of three categories:

1. Mineral
2. Synthetic
3. Vegetable

Mineral oil base is still by far the most prevalent in all the lubrication industry. A mineral base makes a fine lubricant and is derived from crude oil. The main thing to understand here is that while all mineral oils come from crude, they can be radically different producing a wide variety of different qualities depending on how they are refined. Refining processes on crude oil can enhance or detract wanted or unwanted qualities depending on the desires of the finished product. With mineral oil, refining is done to enhance or optimize the desired qualities of the product and can lead to vast differences in the finished product.

Synthetic oils are man-made through a synthesizing (man-made chemical) process and come in a number of formulations with unique properties for their intended purpose. For synthetically generated oils, the objective of the various formulations is to create a lubricant with properties that may not be achievable in a mineral oil. Whether mineral-based or synthetic-based, each base oil is designed to have a specific application. Today, 55% of polled lubrication professionals use both mineral and synthetic based products in their daily and recommended uses.

Vegatable base oils, which are derived from plant oils, represent a very small percentage of lubricants and are used primarily for renewable and environmental interests. Vegetable based lubricants are perhaps most widely used in the food industry. Vegetable lubricants are a growing industry that is attempting to appeal to earth friendly customers and those seeking a more renewable resource for

lubrication. A major consideration when using any vegetable-based lubricant is its compatibility with mineral or synthetic based lubricants, or

Currently the breakdown for the various based lubricants in percentage of global use is generally represented as follows:

1. Mineral 85%
2. Synthetic 12%
3. Vegetable 3%

For a serious study on Base Oil Groups, please refer to a report put together by the American Petroliam Institute posted HERE.

II. Compatibility: The next step to understanding lubricants and using them on your firearms is compatibility. Many lubricant are not compatible when they come into contact with each other in a working environment. Here's a practical example - when two people who are incompatible come into contact in a working environment, the result will at the very least be lack of productivity and the two not working together. If you were at add pressure to their tasks like increased speed or increased requirements for success, the likelihood is you could end up with one employee fighting with another. Lubrications work under the same principal. If you are using two incompatible lubricants, then at the very least, they will reduce the productivity of the firearm. One working alone is almost always better. If in that same working environment in your firearm, you increase heat and increase pressure, the results can be catastrophic. The two elements begin working against each other, heat rises, friction increases, and the "fighting" ends up stopping your firearms cycling.

All lubricants in the firearms industry are not compatible. Some synthetics contain components that will break down mineral based lubricants. Additionally, two mineral based lubricants can also work against each other to cause to your lubrication to be less, or completely, ineffective.

At the very least, mixing different lubricants may lead to a degradation of lubrication's performance. As an example, mixing the same grades of synthetic motor car motor oil and mineral oil-based engine oil may not damage the engine, but you will lose the performance features you expect from the synthetic. However, it is also possible that mixing incompatible mineral and synthetic based lubricants could create disaster. Deposits may form that could actually increase wear and cause irreparable damage to the system[1].

Examining Base Oils:

While it is never popular to start with a negative, if there is one piece of advice we at Rattac Technologies can share, it's this: please do not use a vegetable oil based lubricants on your firearms.

Can vegetable oil provide lubrication? Sure, for a time. Will that lubrication benefit your firearm? In the long term this is an easy answer; Absolutely not. Can it protect your firearm? No. Before you brand us as having an agenda, let us explain.

While vegetable oil may seem to have benefits you prefer over mineral or synthetic based oil, there is always a tradeoff. A recent report stated, "While more than 70% of commercially available lubricants are from crude oil/hydrocarbon, commercial formulation of lubricants using vegetable base oils are gaining

[1] Always check compatibility of different base lubricants before use. If credible information is not available to determine compatibility, there are some simple tests you can perform. Heat an oil mixture or two oils you want to test for compatibility and examine for clarity. If the mixture is cloudy, the oils are not compatible. To check further, add a small amount of water, mix thoroughly, and continue heating. Allow the mixture to sit at room temperature for several hours. If a solid forms in the oil, they are incompatible. https://www.machinerylubrication.com/Read/28867/mix-synthetics-mineral-oils#:~:text=In%20its%20mildest%20form%2C%20mixing,you%20expect%20from%20the%20synthetic.

global interests. Lubricants obtained from bio-based oils are eco-compatible but are ***widely reported to be thermally and oxidatively unstable***[2]..”

Vegetable Based Oils

Being that they are vegetable based, it should not surprise you that they are 95% biodegradable, meaning they break down quickly. Sitting on the shelf, never being used, vegetable oil will begin degradation as soon as it is bottled. It will degrade 30-30% faster than the average mineral-based oil. Additionally, vegetable-based oil degradation is increased at a rate much higher than mineral or synthetic based oils when in use. Meaning, under pressure and heat their viscosities increase, reducing the lubrication factor, creating more heat also causing sediment and sludge formation. In a continuing circle of decreased benefits, heat and friction continue to increase even further. As thermal and oxidative breakdown continues, the product you purchased to lubricate your firearms does the opposite.

To make matters worse, this break down (thermal and oxidative) increases sediment and sludge formed from the bio-elements, and reduces or eliminates foaming control - which in-turn creates more sludge As the bio-elements break down and mix with moisture in the air, the result is the creation of corrosive acidity. Left unremoved, the bio-bases will cause the increased formation of acids, corrosion will begin and will begin where ferrous metals exist.

Again, in the end, and left sitting on your firearm, the very thing you are trying to prevent will be accelerated.

Our caveat: If you decide that the value to vegetable-based oil lubricants are the direction you want to go, our recommendation is to refresh the lubricant regularly when using. Always keep the firearm moist with lubricant to keep the lubricant thin and watery. Do your best to keep temperatures down (shoot more slowly – “no mag-dumps”) while in use as well for best results. Lastly, totally strip the vegetable oils from your firearm before long term storage. By totally strip we mean using a quality solvent (Weapon Shield™ solvent preferably) to totally remove ALL remnants of the vegetable-based oil from the firearm. Recoat the metal portion of the firearm with a mineral or full synthetic oil before storage. We simply cannot, in good conscience, ever recommend storage of a firearm using vegetable-based oils, period. Bio-products rot. Any protection they may have given could be gone in a matter of weeks if not days. And, with full certainty, at some point those bio products will rot, produce acids and harm will come to your firearm.

Fully Synthetic Based Oils

Fully synthetic oils have their place in the world, and in the firearms industry. Synthetic lubricants can be manufactured using chemically modified petroleum components rather than whole crude oil. They can also be synthesized from other organic raw materials. The base material used however is still overwhelmingly crude oil that is distilled and then modified physically and chemically, “synthesized” to fit a specific purpose.

Because synthetic oil is made in the lab, each manufacturer takes different approaches. While no manufacturer is about to share proprietary information about the process, we do know that full synthetic, or 100 percent synthetic oils, are usually extracted from crude oil or a byproduct of the same although abiotic production is a fact of science.

To create the fully synthetic-based oil, the refined oils molecules are broken-down chemically and then artificially reformed (synthesized) using a variety of processes. This reassembly process varies from manufacturer to manufacturer and is engineered to fit a predesigned purpose. That resulting oil is then

[2] Stability of vegetable based oils used in the formulation of ecofriendly lubricants – a review” https://www.sciencedirect.com/science/article/pii/S1110062120300064#:~:text=Also%2C%20vegetable%20based%20materials%20are,mineral%20based%20materials%20%5B20%5D.

used to create the base into which are mixed the additives to create the specific formula the manufacturer is trying to create.

Synthetics boast a greater 'stability' than pure mineral oils, as well as a higher flash point making them safer in higher temperatures. Fewer impurities create a very uniform composition of the oil which can be a benefit over the non-synthesized mineral oils. I confess, that in these simple points alone the average off-the-shelf synthetic-based oils are more stable, probably have a higher flash point and likely have fewer impurities that the average non-synthetic mineral based oils. But does all that equate to a better product than mineral based oils?

Mineral Based Non-Synthetic Oils

Mineral-based oils represent the vast majority of the firearm lubrication products on the market today. Mineral-based oils originate from natural sources like crude oil found in the ground in almost innumerable quantities. As a matter of fact, with the exception of the global downturn of economies during Covid, crude oil production has grown almost every single year since 1990[3] and on average almost every year since it's discovery in Titusville, PA in 1859. Every year usage goes up, production goes up, and discovery of new and crude reserves are located. As crude oil availability seems to be so continually available, the hypothesis of Abiogenic petroleum production continues to gain in credibility in scientific spheres, but also in likelihood[4]. Clearly this does not please the global climate change agenda, but facts are facts.

Made of hydrocarbons that break down into smaller molecules when heated up, mineral-based oil moves easily around moving parts while dissolving, flooding and removing dirt and other debris.

Mineral-based oils are vast in numbers because of their proven effectiveness, their affordability, and their availability in the form of raw materials. In their basic form, mineral-based oils remain prominent because they are lower in cost, accessibility and yes, are environmentally sustainable.

This is the category into which Weapon Shield™ falls.

Creating the Right Lubricant

Where fully synthetic and mineral based lubricants differ in the way their base oil is produced, what they have in common is the practice of improving the lubricant with additives. Through the process of introducing selective chemical additives both synthetic and mineral based lubricants are enhanced in very specific ways to meet very specific challenges.

In the world of motor oil, additives can assist in reducing friction and wear (viscosity enhancers), but they are also specifically formulated to break down in time to demand replacement. Some additives are directed at enhancing engine cleanliness by washing away deposits (detergents), and providing better protection against oxidation and corrosion (corrosion preventatives). All this to improve overall performance and efficiency. Specialized blends are specifically designed for applications like engine break-in and high mileage. As you can see, customizing an oil for a vehicle engine can be very specific and very detailed.

When Weapon Shield™ was designed by Dr. George Fennell, he had no other goals or agendas in mind other than designing the best lubricant possible for his chosen application – firearms. What does this take? Being an expert in both tribology and firearms operations, George had a step up on most of his competitors. Tribology[5] is defined as the science and technology of interacting surfaces in relative

[3] https://yearbook.enerdata.net/crude-oil/world-production-statistics.html
[4] https://energyskeptic.com/2016/abiotic-oil-theory-and-its-implications-for-peak-oil/
[5] https://www.sciencedirect.com/topics/engineering/tribology#:~:text=Tribology%20is%20defined%20as%20the,realized%20for%20thousands%20of%20years.

motion. It includes the study and application of the principles of friction, lubrication and wear. Understanding the mechanical function of firearms and the forces and frictions that are part of the operations was a study that George took on because he saw the need. As an active action shooter himself and seeing the problems that were being experienced on the firing line, he used his knowledge in tribology to design a solution.

What Properties are Needed to Improve the function of a Firearm with Lubrication?

The Oxford dictionary defines lubrication as “the action of applying a substance such as oil or grease to an engine or component so as to minimize friction and allow smooth movement.” This is a supremely over generalized definition but meets the satisfaction of the common vernacular. For our purposes we will define lubrication as “the control of friction and wear by the introduction of a friction-reducing component between moving surfaces in contact.”

Firearms have the same lubrication problems related to their proper function that anything with moving parts experiences - friction. But every firearm is not the same. Overcoming the coefficients of friction and their effects on the operation and longevity of a revolver vs. an AR15 as an example, are completely different.

Revolvers, lever actions, bolt actions, falling or rolling block single shot rifles or break-action shotguns require low levels of friction reduction. On the other side of the coin, semi-automatic, and fully automatic firearms produce moments of combined friction and energy that need very specific treatment if they are going to be lubricated properly allowing for proper and reliable function of the mechanism. While a poorly or unlubricated revolver may continue to work without incident, shooters will soon learn that such is not the case with present-day advanced repeating and autoloading firearms.

With modern firearms comes a new level of lubrication need that for the most part has never really been addressed properly. At least until Georg Fennell invented Weapon Shield™.

The force, pressure, velocity and heat components that are brought into the equation when considering proper reliable function of modern autoloaders is diverse and incredible. These forces and heat elements are increased exponentially over considerations of revolver, single-shot and break action firearms. So much so that each component needs to be considered when formulating a proper CLP for use in all aspects of firearms usage.

The Super-Power of Advanced Boundary Film (ABF) Technology

As we have shown earlier, lubricants are pretty similar in base with variations in additives. Advanced Boundary Film (ABF) protection is what makes Weapon Shield stand out from all the others.

Boundary lubrication is one of three main types of lubrication:

1. Full Fluid-Film Lubrication
2. Elastohydrodynamic or just Hydrodynamic Lubrication
3. Boundary Film Lubrication

With Full fluid-film lubrication the elements are either fully immersed in the lubricant fluid, or the fluid is at a constant state between the two opposing surfaces. In this case the lubricant is pressurized (naturally or mechanically) to force the two surfaces away from each other and therefore friction is greatly reduced. Heat, surface smoothness and weight of the two surfaces all impart variables to the lubrication needs.

Elastohydrodynamic lubrication works differently. This type of lubrication provides the answer to why many mechanisms operate under conditions that are beyond the limits thought possible. Research has shown however that the effect on lubricants of high contact pressure creates a large increase in the viscosity of the lubricant. This viscosity increase combined with the elasticity of the metal causes the

lubricant film to act like a thin solid film, thus preventing any metal-to-metal contact. (see noted ScienceDirect.com article in the footnotes).

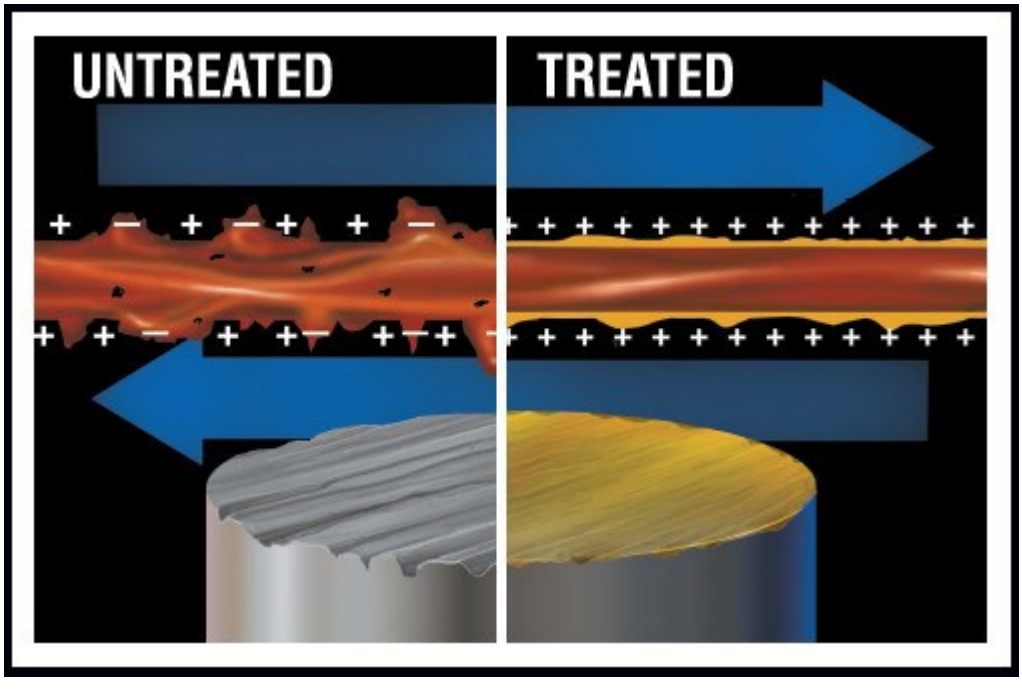
Boundary lubrication is also nothing new. In more detail, boundary lubrication is perhaps best defined as the lubrication of surfaces by fluid films so thin that the friction coefficient is affected by both the type of lubricant and the nature of the surface and is largely independent of viscosity.

A fluid lubricant introduced between two surfaces may spread to a microscopically thin film that reduces the sliding friction between the surfaces. The peaks of the high spots may touch, but interlocking occurs only to a limited extent and frictional resistance will be relatively low.

A variety of chemical additives can be incorporated in lubricating oils to improve their properties under boundary lubrication conditions. Some of these additives react with the surfaces to produce an extremely thin layer of solid lubricant, which helps to separate the surfaces and prevent seizure. Others improve the resistance of the oil film to the effect of pressure.[6]

Here is where Weapon Shield's™ technology and George's genius come into play. Through years of study and practical application George Fennel formulated Weapon Shield™ used additives in ways no other tribologist has done. The select and proprietary Weapon Shield™ formula of additives not only creates the best conditions for boundary film lubrication, but it also ADVANCES the science of ABF with George's additives to do the following:

- Remove asperities (small particles of material removed from the surfaces of the opposing metals)
- Trap the asperities in the fluid removing them from causing friction or further damage to the materials surfaces
- Chemically create two positively charged surfaces that repel each other and repel asperities
- Increase lubrication properties by increased pressure
- Improve metal surfaces thereby reducing friction
- Remove and repel moisture from the surfaces
- Impart strong corrosion protection



[6] Science Direct: https://www.sciencedirect.com/topics/engineering/boundary-lubrication#:~:text=Boundary%20lubrication%20is%20perhaps%20best,is%20largely%20independent%20of%20viscosity.

As you can see, ABF technology is not just a method of lubrication, but a self-perpetuating improvement process that reduces friction, heat and leaves the user with improved metal surfaces.

No other firearms dedicated lubricant can challenge Weapon Shield™ or boast such performance. This ABF Technology is unique to Weapon Shield™ from Rattac Technologies, LLC.

Making Modern Firearm Operate Reliably

As we have seen with revolvers and other types of firearms, there are some firearms that produce lower states of friction when in operation. Revolvers, lever actions, slide-action (pump) shotguns, or falling/rolling block actions all require minimal lubrication to function. So does this mean Weapon Shield™ is over-kill? No, and here's why.

Protection Beyond Friction

Just because a firearm's moving parts are not exposed to high heat and/or high pressures with every cycle or function of the firearm does not mean that they do not need protection beyond just the reduction of friction to prevent wear. Weapon Shield™ does so much more than just reduce friction.

Weapon Shield™ is a full Cleaner, Lubricant and Protectant, commonly called a "CLP." Using Weapon Shield™ alone will help break up carbon deposits, lead and copper fouling and more. Weapon Shield™ solvent is a far better pure cleaner as it is focused on the cleaning element of CLP only. Once cleaned, Weapon Shield™ is designed to microscopically penetrate fissured surfaces protecting all metal surfaces from and repelling moisture that will cause corrosive results, especially if any carbon remains on the surface of the metals.

Carbon, along with copper, lead and the general residues of shooting that remain in the action and the firearm's barrel is commonly called "fouling". The reason that it is so important to clear out all this fouling is because these materials are all hygroscopic. This means they absorb moisture from the air and when that moisture combines with the fouling residue it creates caustic elements like hydroxide or sodium hydroxide that corrodes most steel. Carbon residue will attract moisture for certain. That moisture will combine with Carbon Dioxide from the air creating carbonic acid and more water, which perpetuates the process. Carbonic acid and sodium hydroxide can be caustic to some metals causing rust but can (in most cases) be seen early on as forming a building layer of white flaky power which is actually extracted sodium carbonates. This process is most frequently observed on parkerized parts like 4140/4150 carbon steel AR15 barrels and parkerized steel parts in general. Leaving these fouling elements unremoved or your bore untreated is inviting disaster.

Once cleaned of all carbon and fouling, Weapon Shield™ treated metal surfaces will have a smooth, silky texture to them, and will help your firearms prevent additional fouling. This Advanced Boundary Film protective layer helps repel metal, and adds in preventing carbon and fouling from attaching to the rifle's bore surfaces. Additionally, you'll notice an appreciable difference in ease of cleaning moving forward in any Weapon Shield™ treated bore.

Accuracy Shooting, Barrel Break-In and Handloaders

Speaking of a Weapon Shield™ treated bore, let's elaborate on this.

One question frequently asked is, "will Weapon Shield™ increase the accuracy of my firearm?" The short, and technically accurate answer is no. There is no magic goop, Weapon Shield™ or otherwise, that can by simply being placed in a rifle's bore and by itself increases the inherent accuracy of a barrel.

However, Weapon Shield™ can and does help reduce your group size. Splitting hairs you say? Talking out of both sides of our mouths? Let me explain.

This writer, having worked for nearly 25 years in the barrel making industry, has a pretty good understanding of barrels and turning rifled-blanks into tack-driving rifles. A great deal goes into the process, and if given enough thought, it's easy to realize that as much of the success of any individual barrel comes after it is mounted as before. However, the inherent accuracy potential of the barrel itself is built into it from manufacturing, and that cannot be reasonably changed[7]. What Weapon Shield™ can do is not magic, it's simply technology that allows you to be a better shooter.

When a rifle's bore is treated with Weapon Shield™, it immediately changes the bore of the barrel through the Advanced Boundary Film technology. The ABF benefits are not only based just on the lubricant itself, but in the electro-chemical bonds made between the bore's surface and the Weapon Shield™. Additionally, and here's where Weapon Shield™ really makes a difference – continued use of Weapon Shield™ works to smooth the bore's surface by removing surface irregularities and recontouring the asperities on the barrel.

ABF Technology creates the bond that does three main things:

1. It works to prevent the attachment of fouling elements
2. Creates a bonded lubricant layer that assists in stabilizing
3. Stabilizes the barrels bore to reduce Extreme Spread and Standard Deviation

As most handloaders will tell you, reducing Extreme Spread (ES) and Standard Deviation (SD)[8] are critical, perhaps THE MOST critical factor in producing accurate groupings among a string of shots. By treating your bore, and yes, with a quality barrel break in process with Weapon Shield™, you will be preparing your rifle for the best results that your barrels is capable of producing.

Reducing ES and SD makes your bullet velocity more consistent, which means if the shooter is doing their part, it will make your point of impact more consistent as well – reducing group size. In this manner Weapon Shield™ does not make your rifle or barrel more accurate, it makes it more consistent – which allows you the shooter the ability to be more accurate. See the difference? Consistency is everything in accuracy shooting.

Weapon Shield™ helps your bullet travel the length of the bore with less resistance and a more consistent velocity. One might think that reduced drag would produce greater velocities. However, reduced drag also allows for lower pressures behind the bullet which causes reduced velocities. Powder types, atmospheric pressure, elevation, and temperature all play roles in which way this pendulum might swing in your particular circumstance. We have seen customers report greater velocities with Weapon Shield™, and we have seen people report lower velocities. Both make sense and both possibilities, but improved ES and SD are almost always reported and are to be expected. Some reports have seen SD reduced by 80%. While that number will vary in case to case and from person to person.

Bottom line, Weapon Shield™ will make a difference when it come to you being able to produce tighter groups, keeping cleaner bores, reduce fouling, and make your firearm last longer all while helping you produce the best groups that you and your rifle are capable of.

[7] There are machining processes that can improve a rifle's inherent accuracy by cleaning up rifling grooves and/or smoothing surfaces (lapping etc.), but these processes can only work on the foundation they have been given. If the barrel is not consistent in its surface tension, level of surface disparity, has unacceptable deviations in bore dimensions (e.g. air-gauging), no machining, freezing or lapping process will make that barrel as good as one that does not present those variable deficiencies.

[8] https://www.gunsandammo.com/editorial/long-range-shooting-understanding-extreme-spread-and-standard-deviation/247510

Lubricant Types Rattac Recommends Avoiding

Teflon®/PTFE Based Products

If you have the time to spend going down a proverbial rabbit-hole of Teflon® /PTFE/CF4 chemicals, their proven toxicity, carcinogenic properties and the fact that temperatures of this product over temperatures as low as 325°F, please do. Better yet, watch the 2019 film ***Dark Waters*** starring Mark Ruffalo and Anne Hathaway outlining the effects of Teflon on people and the environment.

We commonly think fluids when we think lubrication. Things like oil and grease. But a lubricant can technically be a solid as well. Why do I bring this up? Because some common firearms lubricants are just that – a plastic or engineered substance that reduces friction but is a solid that is suspended in a liquid carrier. Some of these lubricants use copious amounts of Teflon® suspended in an oil carrier. In general, any lubricant that uses a suspended solid as a primary additive to the lubrication process, is a bad idea.

Suspended solids in lubricants generally need to be seriously considered for use. They may have quality traits that are positive benefits in some applications, but firearms is generally not one of them.

Teflon, graphite, molybdenum sulfide are commonly used in firearms lubricants[9]. Under the right circumstances their lubrication properties can provide immediate assistance to reducing friction. However, any immediate improvements are more likely based on the carrier than the suspended solid, and most long-term effects will prove detrimental, if not harmful.

Lubricants with suspended solids tend to create sludge as the carrier deteriorates with heat or pressure or evaporates. What's left is the suspended solid that is now likely acting to increase friction. Even worse, that solid, now a sludge is a dirt and abrasive attractant that will quickly become an unintended griding compound, the last thing you want on your handgun rails, or inside your aluminum upper receiver.

Weapon Shield™ recommends avoiding such lubricants for the protection of your firearms investments.

Weapon Shield™ Black Paper
Author: Tom Spithaler
CEO – Rattac Technologies, LLC.
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[9] Solid Lubricants and their Properties: https://www.sciencedirect.com/topics/materials-science/solid-lubricant#:~:text=Graphite%20and%20molybdenum%20disulfide%20are,et%20al.%2C%202018).

BOUNDARY FILM LUBRICATION THROUGH ADVANCED HALOGENATION TECHNIQUES:
OXIRANE ACID SCAVENGING AND ORGANO-METALLIC SUBSTITUTION

By GEORGE C. FENNELL, L.E.

My proprietary mechanism of operation is based upon Tribology methods that improve lubricity and load carrying capacity by improving surface characteristics and creating a stable chemical, corrosion-controlled halide-based boundary film. Its active components react with each other and the contacting asperities of the metallic surfaces to provide five mechanisms of improvement:

1. Advanced chemical boundary film formation through reactive chemical bonding.
2. Ring opening, oxirane acid scavenging and advanced corrosion inhibition.
3. Organo-metallic substitution of surface metal and free radical reactionaries.
4. Improved surface smoothness and rolling out of irregular contacting asperities.
5. Re-conditioning and molecular reconstruction of the original contacting metal surfaces.

The process of advanced boundary film formation is accomplished with an advanced combination of halogens that are controlled and rendered non-corrosive to the base metals of the system and pose no threat to the ozone layer or waste oil recovery systems due to their origins and long chain molecular lengths. These halogens initially react under thermal conditions with the organo-metallic reagents to form surface attaching compounds, thereby limiting and controlling the formation of halides from the base metals themselves. These surface attaching reagents or "electro-negative compounds" seek out and affix themselves to the lower surface areas referred to as micro-pores and fissures, as all metals are crystalline in structure and exhibit a lattice type matrix. This complex process also incorporates Van der Waal forces and dipole-dipole surface reactions. During this process, surface lapping and asperity *(irregular microscopic contacting and opposing surfaces*) roll-out is also achieved, yielding improved spread characteristics of the surfaces themselves. Due to the increase of film strength by the filling of the micro-pores and fissures, along with thermal modification of the asperities, the resulting effect is a gradual rolling out or flattening of the metal asperities rather than a breaking off or chip-away process, which would create metallic debris in the lubricant leading to abrasive wear from wear metal particles. The resulting improvement in the opposing metal surfaces further increases the fluid film strength, which is dependent on the degree of surface roughness and viscosity.

Viscosity, however, is a lesser consideration when incorporating boundary additives or halogenation techniques.

In general, boundary friction and wear consist of two components, a shear or adhesion component and a plowing or deformation component. Considering the following equation:

$$Fs=SAr$$

Where Fs is the shear component, which predominates except when asperities sink too deeply into a boundary lubricant film or a soft opposing surface. When movement or sliding occurs, the shear friction force depends on the shear resistance per unit area, S, of any "boundary film" in the real load-supporting area between asperities. Dividing by the load, W gives the shear contribution to the friction coefficient, becoming independent of total load and apparent area of contact:

$$fs = S * Ar / W = S / Pp \text{ or } S / Pe$$

The boundary film shear resistance, S, is assumed equal to the plastic flow shear stress, Tp, of an ideal elastic, plastic solid. Such a solid gives shear stress independent of strain and strain rate at strains sufficiently large enough to cause plastic flow. The conditions that produce the "glass transition" from liquid to plastic-like behavior are dependent on the viscosity of the material at normal temperatures and pressures and the variation of viscosity with temperature and pressure. In other words, glass transition depends strongly on chemical composition.

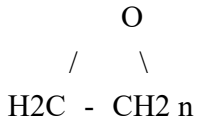
These results show that liquid lubricants act like plastic solids in the films between asperities. Therefore, S=Tp in the previous equation and the friction coefficient is Tp/Pp or Tp/Pe. Since Tp is a weak function of temperature and pressure, and Pp or Pe are independent of apparent contact load, the frictional coefficient for a given combination of lubricant and sliding surfaces tends to be independent of operating conditions.

Elasto-hydrodynamic lubrication (ELH) on an asperity scale deposits film material between sliding surfaces in "micro-rheodynamic" (micro-RHD) lubrication. As one surface slides, each asperity carries with it an aggregation of SST additive. Sufficient pressure and temperature is developed within the film to elastically deform the asperity and to force the extreme pressure reagent between the surfaces or into the micro-pores and fissures. During this time, high thermal conditions involving pressure and asperity contacts initiate a re-conditioning of the surfaces utilizing the existing oil to quench and cool the surfaces in the same process. A thermal restructuring of these asperity contact areas creates a deviation from the normal crystalline structure of the metal, expanding it into an austenitic crystalline pattern, which is more evenly structured and allows the SST additive to bond to the actual lattice of the metal, endowing it with new and unique properties upon cooling.

Organo-metallic substitution is a technique developed and designed to inhibit the process of halide formation from the base metals of the system under reaction. For example, instead of the halogen reacting with the iron in the system to form iron halides, a boundary surface salt, it reacts with a reagent having very similar properties to the iron atom itself, thereby forming a organo-metallic complex without scavenging the target metal surface itself, and depleting the metal in a chemically corrosive wear syndrome.

The process is very similar or analogous to the saponification of organo-metallic compounds in the manufacturing of greases. During this reaction or saponification,

compounds react at a certain catalytic temperature and exchange characteristic components to form new compounds. These new chemical compounds are then used to aid in a boundary regime by providing an added protection to the actual surfaces being lubricated. Ring opening oxirane acid scavenging and corrosion inhibition is another chemical technique used to neutralize acids and inhibit oxidation and corrosion. This technique involves the use of specifically engineered complex ethylene oxide; oxirane rings, that possess reactive reagents which will cause a cleavage of the ring when encountering acids or strong alkaline. These reactions occur in the presence of both anionic- and cationic-type catalysts. Anionic catalysts can include alkoxide ions, hydroxides, metal oxides, and some organo-metallic derivatives while Lewis acids and protonic reagents initiate cationic reactions.



Ethylene Oxide Reagent n

The lubricity, load carrying capacity, surface improvement, and wear reduction are greatly improved while corrosive aspects of halogenation are virtually eliminated.

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