Welcome to Salvo Defense

Salvo Defense is an innovative company with extensive expertise in government programs, prototyping, manufacturing, and project management.  Salvo Defense strives to remain at the forefront of new and emerging technologies and marries them to our customers' needs.  We will often adopt externally developed technologies, incorporating them into our R&D efforts; then quickly transition through prototype to full manufacture.  This enables us to often meet or exceed our customers' expectations and ultimately provide them with a cutting-edge product at a reasonable cost.  Salvo Defense relies on the internal expertise of the various companies of Salvo Technologies as well as decades of experience, carefully chosen strategic partnerships and life-long relationships.  Salvo Defense's core competencies stretch into multiple market segments that include defense, aerospace, maritime, transportation, and security.

## About Us

Salvo Defense was established to be a full service contract designer and contract manufacturer of electro-optic (EO) components and assemblies. With reach in multiple arenas including fire control optics, binoculars, range finders, laser designators and sensing and imaging platforms including multispectral systems, Salvo Defense is known in the industry as a high-end designer and manufacturer of equipment and tactical gear for military and police forces around the world. Salvo Defense does not limit its capability by what “was” but expands its reach by embracing what “is” or what “will be” in the future. This expertise also translates into ancillary markets such as medical and aerospace. By commercializing military hardware and leveraging in house optical design paired with world class mechanical, electrical and software engineering Salvo Defense delivers high quality products across multiple markets.

At the core of its operation Salvo Defense designs and manufactures electro-optical components, assemblies and photonic systems. The vertically integrated organization utilizes the full optical manufacturing capability of sister company Salvo EO. Boasting Class 100 work areas and complete control of products from cradle to grave the optical fabrication, optical thin film coating, optical assembly and optical testing is routinely performed in house for ITAR products. The in house operation is also used for fast turn prototyping. Projects can be completed in as little as 8 weeks. This includes optical design, manufacturing of components and testing. When appropriate off shore manufacturing can be used to meet cost targets in commercial applications.

The in house engineering staff focuses on efficient methods of optical design, electrical, mechanical and software engineering for the most demanding applications. Specializing in man portable devices with a focus on fire control, range finding, laser designating and imaging systems the core group is familiar with industry challenges. Developing innovative solutions to meet those challenges is what Salvo Defense does best. Projects such as wide field of view eye piece design and manufacture, large multi-X zoom system design both for variable mechanical and electronic zoom systems as well as low light and multispectral lens design is part of the core competency of the organization.

An example of this expertise is seen in multiple products sold through recently acquired Shepherd Scopes. From red dots and reflex sites to a full family of 6x zoom fire control optics Salvo Defense is continually looking to improve existing products with novel approaches. Take for example the family of rugged fire control optics.  This Shepherd Scopes line of rifle scopes was designed and developed with the plan of making the toughest scope on the planet.  From the scratch resistant Sapphire to the titanium tube the product family is built from the ground up to survive harsh environments and handling.  Manufactured in the US by Salvo Defense's sister company Salvo EO ([www.SalvoEO.com](http://www.salvoeo.com/)) this innovative product has resonated with special force personnel and police forces alike.

Though rifle scopes are complex systems and take years to design the team at Salvo Defense also recognizes sometimes it is the little things that make all the difference. Take for instance the STAR Shader developed by Salvo Defense for Shepherd Scopes. In the past to reduce glare and eye strain when shooting into the sun at sunrise or sunset (common times to see animals during hunting) a hunter would use a plastic cover to “shade” the scope from the sun. However at certain angles there would still be times when this wouldn’t work. Shepherd had gotten many requests to solve this issue but never was able to find a suitable solution. The team at Salvo Defense surveyed the market and realized there was a need not only at Shepherd but industry wide. They set out to find a solution. What they came up with is one of the most simple yet novel solutions in the market today. The STAR Shader is a lens that is mounted on the front of any optic. It tints when hit by the sun. The more sunlight it senses the darker it gets. The user needs to do nothing but concentrate on the shot. This innovative solution was a hit with the Shepherd users and now will be offered across all scope manufacturers. (<https://www.shepherdscopes.com/product/star-shader/>)

Be it very simple products like the STAR Shader or complex optical systems like fire control optics Salvo Defense is up for the challenge. Leveraging its electro-optical design capability Salvo Defense has also moved into the sensors and imaging market to design and build customized EO solutions.  Whether it is retrofitting a current system with new sensors for higher resolution, better response or tuned to a new attenuation region the engineering team can assist customers solving even the most challenging problems.  With a special emphasis on multispectral solutions utilizing the industries best methods you will not suffer the "not invented here syndrome" other design firms exhibit.

Our team starts with a full survey of the best COTS products available ensuring that we are not wasting time redesigning something that already exists.  Most times integrating COTS sensors and imagers with minor modifications to sync all the new products with the old system is all that is needed to solve the operational task.  In addition our AS9100 registered quality control department is set up to guarantee that our products adhere to the highest quality at each stage of production. We strive to stay at the very front of the technology curve. Initiating the merger of science and technology allows Salvo Defense to advance products and consistently keeps us at the forefront of our industry. We have continually positioned our technology department to be at the cutting edge and strive to produce the best products in our class.

## Technology

Salvo Defense prides itself on innovative technologies. This page details some of the latest and greatest technology that can be shared in an open forum. By no means is this all of the technology available today. If you have any questions or would like to know more about this or any of the technology available please contact a sales engineer.

### SWIR Optical Design

Salvo Defense has developed wide band SWIR optics for the changing SWIR market. Short Wave Infrared or SWIR has typically been designed for 900-1700nm. However as manufacturers get thinner and thinner InGaAs substrates the cameras are able to image down to 500nm or below. This creates a challenge for lens designers and manufacturers alike. Salvo Defense has developed processes to allow great on axis transmission through this entire spectral range as well as minimal focus shift. These two developments have allow Salvo Defense to create products that are timely in this ever changing market place. From optical relays and fixed focus lenses to mechanical and electronic zooms Salvo Defense is positioned to be a leader in the SWIR.

### IR Lens Design

IR lenses have been made for decades but now two main drivers have changed the landscape of the marketplace. First IR cameras have come down substantially in cost. In contrast the lens cost has remained the same. In addition many users want to have multispectral solutions (multiple sensors). In this case typically multiple optical trains are utilized. Salvo Defense has created multiple IR lens solutions that reduce cost as well as provide designers options for multiple sensors in different attenuation regions through the same optical train. By vertically integrating the supply chain and manufacturing the lens components as well as assembling the lenses Salvo Defense has been able to reduce cost. Also by utilizing optical materials that have transmission across multiple wavelength regions (silicon, InGaAs, InSeBe, etc) Salvo Defense has multiple single aperture approaches that can be utilized. If you have any questions or would like to find out more please contact us.

### Novel Reticle Designs

With the acquisition of Shepherd Enterprises Salvo Defense increases its portfolio of novel reticle designs.  Incorporating the Shepherd technology into the mix was simple and effective.  The all in one reticle produces range finding capabilities passively, one shot zero and an accuracy unmatched in the commercial hunting market.  In addition to the Shepherd system, Salvo Defense utilizes reticle grids patterns such as the Horus reticles.  These, along with the Shepherd technology, replace antiquated cross hairs and mil dots.  Both reticle systems are made for faster shooting by making wind calls easier, groupings less obscured and more easily seen, and integrating the Speed Shooting Formula right into the elevation hold of the reticle.  The grids allow for precise and quick shots from 800 yards for enhanced shooting and the patented Shepherd reticles use target size as a ranging element.  Salvo Defense has worked both systems into our lines of products as well as produced these for other customers in the fire control optic market.

### STAR Shader Self Tinting Optic

The new Shepherd Scopes STAR Lens cover system is the next generation of sunshader. With our innovative technology we have developed the patent pending sunshader of the future. The Shepherd Star shader boasts 98% transmission with a frontal optic that actually self-tints as it is exposed to sunlight. This adaptable optic acts as sunglasses for your rifle scope as well as a high density military grade protective cover for your frontal scope optic. The Star Shader system screws directly onto your shepherd scope and add less than 1 inch of length to your scope. The Star shader has both anti reflective and anti-glare technology which allows for you to shoot directly into the sun and will not reflect to give away your position. Our patented system is the first of its kind eliminating long tubes on the end of scopes that reduce your field of view. The new Shepherd Star Shader provides you full field of view changing from truly transparent to sunglass tinted in under 40 seconds letting you shoot in any light conditions, stop fighting with the sun and reflected light and let Shepherd help you shoot further. The Star Shader is another example of how Shepherd Scopes is redefining the industry by providing new and innovative technology to change the way people shoot. In addition this optic can be adapted to camera systems and any other optical system that can benefit from self-tinting optics to reduce glare in the direct sunlight.

### Polymer GRIN Material Research

Achieving lightweight eyepieces with polymer materials usually requires aspheric lenses. These aspheric lenses are good for monochromatic performance but the current materials available limit good color correction. This is where polymer gradient index lenses have been shown to provide superior results. Polymer gradient index lenses can be used to achieve a high degree of color correction in WFOV eyepieces.

In the design of optical systems the lens designer is allowed to vary the curvature, the thickness and the index of refraction of each component to optimize performance. However it is possible to manufacture lens elements whose index of refraction varies continuously within the material. These elements are said to be gradient-index components. Gradient-index lenses have been used in optical designs since the 1970’s in academic institutions. The systems designed during that time include binocular and night vision objectives.  The main drawback for these systems has been the lack of gradient index materials, specifically polymer gradient-index materials.

Without the materials available, specifically for polymer based solutions, designers have either used glass versions (which don’t create the same significant weight advantage and cost reduction the polymers do and cannot match the index delta need for this extreme FOV) or simply theorized what could be done utilizing a polymer based solution with manufacturing tbd at a later date.  Salvo Defense is now partnering with leading experts in the field working on creating a viable process for polymer based GRIN lenses.  This technology opens up a very large opportunity across many industries.  Stay tuned for our results.

### Dual Focal Plane Fire Control Optic

Salvo Defense has developed a fully function 6x zoom family of fire control optics that utilizes reticles in both focal planes.  In typical fire control optics the optical system is designed to utilize either a front focal plane reticle or a rear focal plane reticle.  In high magnification zoom systems this makes the reticle manufacturing very difficult.  In the 1x position the user must "see through" the bullet drop, windage and elevation features which are not needed in close combat situations.  However when the user zooms into higher powers these features are then displayed.  Typically reticle manufactures accomplish this by creating very small features (<2microns) that are not visible when in low power but become visible as the optic travels through its zoom range.  This makes the manufacturing of these reticles difficult and costly.  In addition with a single focal plane targeting or ranging with the reticle is somewhat in accurate.

In this design by utilizing both focal planes the features for each reticle are much larger making the manufacturing of the reticles much easier and less costly.  In addition creative designers can use the different optical features to create ranging options in the scope allowing for real time information usable under duress.  By increasing yield, reducing cost and complexity and adding features that no other optics offers Salvo Defense innovated a very mature technology.

### Ship Board Multispectral Imaging

Salvo Defense has created a customizable ship board multispectral imager for elite security forces around the world.  The configurable and upgradeable platform utilizes sensors from the UV/VIS, SWIR/MidWave as well as long wave regions.  With in each region the user is offered the ability to further specify bands of interest for detailed information on everything from chemical identification to tracking of individuals.  The durable construction is designed to meet the rigors of the open waters without sacrificing performance.  The system is also highly upgradeable so when new sensor suites come out the unit is not obsolete.  For a standard fee and cost of the replacement sensor our technical staff with come on site and upgrade the unit to the latest and greatest sensor available.  No longer do teams have to worry about buying a sensor now only to see the next generation product released shortly thereafter.  If the application calls for land or vehicle mounting there is a version available for each.

## Manufacturing

Salvo Defense, a division of Salvo Technologies ([www.salvo-technologies.com](http://www.salvo-technologies.com/)), is a US based manufacturer that serves the security and defense markets.  All offerings are designed and manufactured in strict compliance with mil standards and utilize best in class processes.  Founded on the principals of Six Sigma and Lean Manufacturing while integrating the latest in automation and high efficiency technology Salvo Defense is a premier supplier to defense and security forces.  Product lines include Electro-Optical Assemblies, Sensing and Imaging Platforms, Power Management Electronics and Protective Thick Film Coatings.  Salvo Defense is ITAR and AS 9100 Registered.

Salvo Defense specializes in the highest quality mil rugged photonic devices.  Each product line is designed and built to survive the harshest environments.  For example the Shepherd Rugged Series product line developed for its sister company Shepherd Scopes is arguably the toughest family of scopes on the market.  This series of scopes is designed to be essentially indestructible.  By utilizing world class materials coupled with creative design and 810g shock resistance the rugged line can withstand the rigors of combat and come out unscathed.

By combining excellence in manufacturing and assembly with precision-machined optics and housings fire control optics are only one of the many exciting product lines Salvo Defense designs and produces for the military, security and aerospace markets.  Our modern CNC machining capability allow us to manufacture complex and large components. From one-piece prototypes to high-volume production lines, we can meet any production requirement and are capable of machining a wide variety of materials, including precision glass and crystals, castings, forgings, aerospace alloys, and plastics.

Salvo Defense also provides a full range of senor upgrades to existing EO systems.  Whether you want to add additional sensors to your sensor suite, upgrade less useful sensors with higher resolution or alternative technologies Salvo Defense can create a solution.  Many customers are simply upgrading their current solution as this can be a cost effective alternative to replacing existing complex EO technologies.  It also minimizes additional product training for crew and operators.  The upgrade process is quick and cost effective.  Once the specific technology is identified our team of engineers will manufacture the appropriate materials to upgrade the EO payload.  The upgrade process generally takes only a couple of weeks even with custom mounting brackets and custom cables due to our quick turn internal manufacturing processes.  Salvo Defense also offers a full range of handheld imaging product offerings including SWIR, MidWave, and LWIR monocular/binocular products.

Whether upgrading obsolescent payloads or specifying new mission critical EO packages our engineering department is able to process your requests quickly.  Our team enjoys new challenges presented by our customers and is able to meet these challenges by employing a highly skilled workforce trained for quick turnaround setups and continuous production improvements.  Please contact us to discuss your options today.

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