



System Assessment and Validation for Emergency Responders (SAVER)

Shatter-Resistant Window Film Market Survey Report

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System Assessment and Validation for Emergency Responders

Prepared by the National Urban Security Technology Laboratory

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FOREWORD

The U.S. Department of Homeland Security (DHS) established the System Assessment and Validation for Emergency Responders (SAVER) Program to assist emergency responders making procurement decisions. Located within the Science and Technology Directorate (S&T) of DHS, the SAVER Program conducts assessments and validations on commercially available equipment and systems, and develops knowledge products that provide relevant equipment information to the emergency responder community. The SAVER Program mission includes:

- Conducting impartial, practitioner-relevant, operationally oriented assessments and validations of emergency responder equipment
- Providing information, in the form of knowledge products, that enables decision-makers and responders to better select, procure, use, and maintain emergency responder equipment.

SAVER Program knowledge products provide information on equipment that falls under the categories listed in the DHS Authorized Equipment List (AEL), focusing primarily on two main questions for the responder community: “What equipment is available?” and “How does it perform?” These knowledge products are shared nationally with the responder community, providing a life- and cost-saving asset to DHS, as well as to Federal, state, and local responders.

The SAVER Program is supported by a network of Technical Agents who perform assessment and validation activities. As a SAVER Program Technical Agent, the National Urban Security Technology Laboratory (NUSTL) has been tasked to provide expertise and analysis on key subject areas, including chemical, biological, radiological, nuclear, and explosive weapons detection; emergency response and recovery; and related equipment, instrumentation, and technologies. In support of this tasking, NUSTL conducted a market survey of commercially available shatter-resistant window film, which falls under AEL reference number 14EX-00-BSIR titled Systems, Building, Blast/Shock/Impact Resistant.

Visit the SAVER website on FirstResponder.gov (www.firstresponder.gov/SAVER) for more information on the SAVER Program or to view additional reports on shatter-resistant window film or other technologies.

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1. INTRODUCTION

Shatter-resistant window film (SRWF) is used to protect glass panes in buildings or vehicles from shattering and causing harm to bystanders in the event of blasts, gunshots (ballistic events), or other intrusions. They are used for security in critical infrastructure with high value targets. To provide security personnel with information about this technology, the System Assessment and Validation for Emergency Responders (SAVER) Program conducted a market survey of commercially available SRWF.

This market survey report is based on information gathered between August 2014 and November 2014 from Internet searches, industry publications, and a government-issued Request for Information (RFI) accessible from the Federal Business Opportunities website¹. SRWF included in this report consists of:

- Commercial off-the-shelf (COTS) products for indoor and/or outdoor use
- Products tested against safety standards
- Products in compliance with building codes.

This report focuses on SRWF for law enforcement and/or homeland security and is not intended for window film designed for other applications, such as protecting private homes from severe weather. However, some window film that is used for miscellaneous applications and is also appropriate for law enforcement and/or homeland security is included. Due diligence was performed to develop a report that is representative of products in the marketplace.

2. SHATTER-RESISTANT WINDOW FILM OVERVIEW

SRWF, also commonly known as anti-shatter film or security film, is a laminate used to improve post-failure performance of existing windows. Applied to the interior or exterior face of glass, SRWF holds the fragments of broken glass together in one sheet, thus reducing the projectile hazard of flying glass fragments. SRWF is essentially a fragment reduction film, since the methodology behind this hazard mitigation technique is focused upon retaining glass fragments resulting from blast overpressures or impact by an object. SRWF is often used to protect critical infrastructure such as airports, transportation venues, government facilities, and other buildings vulnerable to attack.

2.1 Current Technologies

Most SRWFs are made from polyester-based materials and coated with adhesives (see Figure 2-1). Anti-shatter films are available as clear or tinted. Clear SRWFs have minimal effects on the optical characteristics of the glass; tinted SRWFs can increase the effectiveness of existing heating/cooling systems while providing a variety of aesthetic and optical enhancements. Most

¹ Federal Business Opportunities, RFI-14-0005, *Shatter Resistant Window Film*, <https://www.fbo.gov/spg/DHS/OCPO/DHS-OCPO/RFI-14-0005/listing.html> (July 28, 2014)

SRWFs are designed with solar inhibitors to screen out ultraviolet (UV) rays, although over time the UV absorption damages the film and degrades its effectiveness. Abrasions on the face of tempered glass can reduce the glass strength, but SRWFs are also available with an abrasion-resistant coating that can prolong the life of tempered glass.

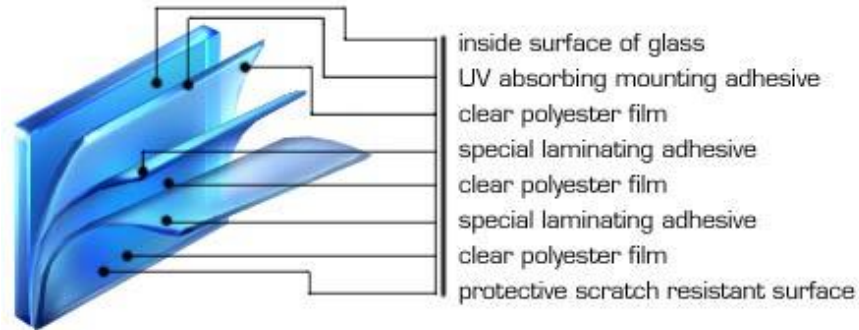


Figure 2-1. Sample Shatter-Resistant Window Film Components

Courtesy of Mid-Atlantic Service & Supply Corporation dba Commercial Window Shield

SRWFs are packaged as rolls that are generally available in widths as small as 24 inches and as large as 72 inches, depending on the manufacturer. Some manufacturers laminate multiple layers of film together in order to enhance performance. Whether one-ply or multi-ply, the overall film thickness can range from 2 to 25 millimeters (mm). According to some government criteria, usually used for embassies and other government critical infrastructure, and published test results, a 7-mm thick anti-shatter security film or specially manufactured 4-mm thick film are considered to be the minimum thicknesses required to provide effective response to blast loads.

There are different types of anti-shatter film installation methods. Depending on the required fragment retention performance and budget constraints, shatter-resistant window protection can be installed on the glass only (known as a daylight application) or physically attached to the window frame (known as attached or mechanical systems). The easiest, quickest, and least expensive method of window protection is to use daylight application. Daylight application involves placing the SRWF onto the clear area of the glass only. This approach will hold glass fragments together but does little to increase the blast resistance of the glazing system. If the blast pressures exceed the strength of the glass itself—somewhere between ½ and 1 pound per square inch (psi)—the entire filmed piece of glass could be pushed into or sucked out of the room. The purpose of the fragment retention window film is to hold the glass shards together in one piece. Since the glass fails before the film, minimum thickness fragment retention films are usually specified. The daylight application method is commonly used for retrofitting windows. Other methods of application may improve film performance and further reduce hazards, but are typically more expensive to install, especially in retrofits.

Attached systems address the requirements of windows with increased security needs. The attachment can be on one, two, or all four sides of the frame and can be achieved with either a

mechanical (metal) or chemical (structural silicone) attachment. SRWF is more effective when it is used in conjunction with a blast-tested anchorage system. While a film may be effective in keeping glass fragments together, it may not be particularly effective in retaining the glass in the frame. Securing the film to the frame with a mechanically connected anchorage system further reduces the likelihood of the glazing system exiting the frame. Mechanical anchorage systems employ screws and/or batten strips to attach the film to the frame along two or four sides. Since additional framework is necessary, the mechanical attachment method can be less aesthetically pleasing than the chemical attachment method, which is also known as a wet-glazed installation system.

Wet-glazed systems are similar to a four-sided mechanical attachment except a silicone adhesive (caulking) is used for the attachment instead of a metal batten. The film is applied to the vision area of the glass and then a bead of high-strength, high-quality structural adhesive is placed around the perimeter of the window frame. The proper thickness and overlap of structural silicone must be used for this method to be effective. It is easier to get a quality installation with this method, but it is also highly installer sensitive. This type of system may be the only choice for certain window frame types. It is generally used in historical buildings—especially windows with multiple small panes where a mechanical attachment cannot be used or will not fit. Heavier gauge films are generally used with this system. The wet-glazed installation system is more costly than the daylight installation system, but is less expensive than the mechanically attached or anchored installation system.

All attachment methods can be installed on site in either steel or aluminum frames. While some mechanically attached systems may be used for a wide variety of windows, others are designed for a particular type of window frame. Certain types of window frames may require a custom-fabricated anchorage system. Additional considerations when selecting an SRWF for installation include the thickness of the film and the task of positioning the film on the glass. A lighter weight or thinner film eases installation. Water used to aid in positioning the film during application must be thoroughly extruded as the film is not very permeable and moisture that does not dry will prevent the development of the full adhesive bond strength.

Anti-shatter film should be carefully examined and chosen for its physical, optical, and thermal characteristics, with special consideration given to the adhesive used, the window thickness, and the window area. Also, window frame systems must be capable of transferring the load collected by the glazing system. Corner-welded frames are preferred over frames constructed of individual components.

2.2 Applications

SRWF is used to counter many threats to buildings and occupants including bomb (blast) attacks, ballistic attacks, burglary or robbery incidents, forced entry, detention containment, and natural disasters such as seismic occurrences, hurricanes, and tornados. The specific threats and required level of protection need to be considered when selecting the most appropriate protective glazing system.

Building codes require protective measures for glass hazards in high-traffic circulation areas that would be prone to easy breakage in order to ensure occupant safety and health. Typically, these codes require that door lights, side lights, interior glass walls, and balcony rails be made of tempered or other strengthened glass. The threat of fire in buildings may also dictate the need for SRWF to protect exiting occupants from the danger of flying glass that could be caused by heat breakage. In addition to providing protection, emergency ingress and egress from buildings must be considered in the design of protective glazing and window systems.

Beyond building codes, however, additional protective glazing measures have traditionally been employed in defense installations, industrial facilities, financial institutions, and detention facilities. Today, primarily because of the increased threat of terrorism, all federal buildings require enhanced levels of protection from the hazards of glass. Approximately 75 percent of all damage and injury from bomb blasts can be attributed to flying and falling glass following the explosion. Even high-profile private buildings, including tall buildings and places of public assembly, are now routinely evaluated for enhanced glazing protection measures. SRWF is a key component of "hardened" buildings, and the ultimate goal of hardened buildings is to provide security for building occupants and assets.

Analytical tools are available to estimate the performance of facades in response to blast loads or to assess compliance with established specifications for blast performance. Many of these performance specifications contain the criterion that the façade must be a balanced design. A balanced design means that all the materials used in a structure maximize the potential energy dissipated due to deformation and manage the failure mechanisms. This is accomplished by assuring a controlled sequence of failure. The performance criteria of the existing façade systems will determine the effectiveness of the existing mullions, connections between the different components, and the anchorages to the structure. The performance criteria of the building should be taken into account when determining the type of SRWF and the installation mechanism to be used.

2.3 Standards/Regulations

There are a number of standards produced by ASTM International, the U.S. Department of Defense (DoD), the U.S. General Services Administration (GSA), and other federal agencies that address a window system's performance against a particular combination of blast-load and distance. However, there is rarely any guidance given beyond the general statement that windows should be able to resist a static load. Additionally, because of the uniqueness of each building's existing conditions and physical security design requirements, there are a limited number of codes and standards that apply to retrofitting for blast mitigation.

Currently, two independent test standards exist for explosive testing of window systems in the United States:

- GSA Test Standard (GSA-TS01-2003) – Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings
 - Used by GSA and other non-DoD agencies using the Interagency Security Committee (ISC) Security Design Criteria

- Available at no cost from the GSA (<http://www.gsa.gov/portal/content/103201>)
- ASTM Test Standard (ASTM 1642-04) – Standard Test Method for Glazing and Glazing Systems Subjected to Airblast Loadings
 - Widely used by some DoD components
 - Available for purchase from ASTM International (www.astm.org/).

No universally accepted blast test standard currently exists in the United States for typical building components other than window systems. Other standards and guidance that companies use to test their products include:

- American National Standards Institute (ANSI)
 - ANSI Z97.1 – Standard - Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test
- ASTM International
 - ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials
 - ASTM E1886 – Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
 - ASTM E1996 – Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes
 - ASTM F 2248-03 – Standard Practice for Specifying an Equivalent Glazing Fabricated with Laminated Glass
- Consumer Product Safety Commission (CPSC) Code of Federal Regulations (CFR)
 - 16 CFR Part 1201 – Safety Standard For Architectural Glazing Materials
- U.S. Department of Defense
 - DoD 6055.9 STD – DoD Ammunition and Explosive Safety Standards
 - FM 3-19.30 Physical Security – Sets forth guidance for all personnel responsible for physical security
 - Unified Facility Criteria (UFC) 1-200-01 – Design: General Building Requirements
 - UFC 4-010-01 – DoD Minimum Anti-Terrorism Standards for Buildings - Establishes prescriptive procedures for threat, vulnerability, and risk assessments, and security design criteria for DoD facilities
- U.S. Department of State
 - Architectural Engineering Design Guideline (5 Volumes) (limited official use only)
 - Physical Security Standards Handbook, 07 January 1998 (limited official use only)
 - Structural Engineering Guidelines for New Embassy Office Buildings, August 1995 (limited official use only)
- European Standards
 - British Standards Institution BS 6206 (Class A, B & C) – British standard impact testing for annealed glass with applied safety film

- European Committee for Standardization BS EN 356 – Glass in Building and Security Glazing (in order of increasing resistance, lower resistance levels are P1A, P2A, P3A, P4A, and P5A; higher resistance levels are P6B, P7B, and P8B)
- European Committee for Standardization BS EN 12600 (in order of highest to lowest performance Class 1B1, Class 2B2, and Class 3B3) – Standard for Safety Rated Glass
- Germany Bulletproof Standard DIN 52290
- Underwriters Laboratory of Canada ULC-S332-93 (R1998) – Standard for Burglary Resisting Glazing Material
- International Organization for Standardization (ISO) 16933– Glass in Building - Explosion-resistant Security Glazing - Test and Classification for Arena Air-blast Loading
- Private Sector Guidelines
 - Blast Effects on Buildings: Design of Buildings to Optimize Resistance to Blast Loading by G.C. Mays and P.D. Smith. London: Thomas Telford Publications, 1995
 - American Concrete Institute 318, Chapter 21
- Underwriters Laboratory (UL) 972 – Burglary Resisting Glazing Material
- Factory Mutual (FM) Approval Standard for Windstorm Resistant Fenestrations, Class Number 4350.

3. PRODUCT DATA

This market survey identified seven SRWFs from five manufacturers. Some vendors offer alternative models with different features and options for a single SRWF model. The products ranged in price from under \$1,000 to almost \$2,000 for a single roll of SRWF. All vendors included here recommended that they be contacted for pricing estimates for specific jobs, since price is dependent on the size of the window and the installation options chosen. All vendors included in this market survey offer volume discounts on their products.

Table 3-1 compares different features for these SRWFs. Sections 3.1 through 3.7 give descriptions of individual products. Product data presented in this report was obtained directly from manufacturers, vendor literature, and websites between August 2014 and November 2014. The information has not been independently verified by the SAVER program.

Features in Table 3-1 are defined as follows, listed in column order:

Company: the manufacturer or vendor of the SRWF.

Product: the model name of the SRWF.

Price: the manufacturer suggested retail price in dollars of the basic unit. Volume discounts and GSA pricing are available for many products.

Applications: the applications that the product is marketed and certified for, such as break-ins (BI), severe weather events (SWE), anti-ballistic (AB), ballistic resistant (BR), blast and impact events (BIE), human impact (HI), and seismic events (S).

Retrofittable: whether the unit may be retrofitted into existing windows and building.

Tested to Standards: whether the SRWF has been tested to any international, national, or state standards.

Materials: the main materials or components of the SRWF.

Visible Light Transmittance (VLT): the percentage of light that the SRWF transmits.

Ultraviolet (UV) Light Protection: whether UV protection is provided by the SRWF.

Tinted/Color Options: whether the unit has tinted (darknesses) or color SWRF options for customers.

Thickness: range of thicknesses available in millimeters (mm).

Table 3-1. Product Comparison Matrix

Company	Product	Price (\$)	Applications*	Retrofittable	Tested to Standards	Materials	VLT (percent)	Ultraviolet (UV) Light Protection	Tinted/Color Options	Thickness (mm)
Absolute Perfection, Inc.	LLumar Safety and Security Films	358-1,856 †	BI, SWE, AB, BR, BIE, S	●	●	Clear, heavy-duty polyester compound	89	●	●	4-15
Mid-Atlantic Service & Supply Corporation dba Commercial Window Shield	8 Mil Clear Safety and Security Film	NA	BI, SWE, BIE	●	●	Laminated layers of polyester	NA	●	●	4-21
Service Group Distribution	Pentagon Safety and Security Window Film	NA	BI, SWE, BIE	●	●	NA	84-86	●		4-15
	Hanitatek Safety and Security Window Film	NA	BI, SWE, BIE	●	●	NA	20-89	●	●	4-15
Solar Gard Saint-Gobain	Armorcoat Safety and Security Film	960-1,380	BI, SWE, BIE, HI	●	●	Polyester film, pressure-sensitive adhesive, acrylic scratch-resistant coating	20-89	●	●	10-25
3M	Safety & Security Window Films Ultra S600 and S800	NA	BI, SWE, BIE, S	●	●	Clear microlayered polyester-blend film, weatherable pressure-sensitive adhesive, acrylic abrasion-resistant surface	84	●	●	6-8
	Safety & Security Window Films S70, S80, and S140	NA	BI, BIE, S	●	●	Conventional PET (polyester) film	84	●	●	7-14

● The product has this feature.

NA Information on this feature is not available.

† GSA price available.

* Break-ins (BI), severe weather events (SWE), anti-ballistic (AB), ballistic resistant (BR), blast and impact events (BIE), human impact (HI), seismic events (S).

3.1 Absolute Perfection, Inc.: LLumar® Safety and Security Films

LLumar Safety and Security Films are made with thick, heavy-duty polyester bonded by strong adhesives. These films provide an optically clear SRWF. The Safety Films protect windows from windborne debris, seismic tremors, and accidental impacts. The Security Films are used in high-traffic areas where windows or other surfaces are vulnerable to “smash-and-grab” theft or vandalism.

LLumar Safety and Security Films have been tested by independent laboratories and have been determined to meet or exceed the specifications and requirements set forth by the CPSC in 16 CFR section 1201.4, which outlines test procedures for safety glazing materials. Additionally, Safety Films has met the following certifications and test standards in the United States, Europe and other parts of the world, including: ANSI Z97.1, CPSC 16 CFR 1201 Cat I (for products less than 9 square feet) and Cat II (for products of unlimited size), GSA-TS01-2003, UFC 1-200-01, ASTM E1886 Large Missile Level C and Small Missile requirements, UL972, FM Approvals 4350, and EN356 level P2A.

Other properties and specifications for this product include:

- Available thicknesses: 4, 6, 7, 8, 11, and 15 mm
- VLT for clear film: 89 percent
- UV protection: 99 percent
- Available in 36-, 48-, and 72-inch wide rolls.
- Available in Neutral (VLT 20 percent, 40 percent, 50 percent), and Reflective (VLT 20 percent).
- Only SRWF available with GSA pricing.

LLumar films are warranted against crazing, peeling, discoloration, demetallizing, and delaminating when installed on suitable interior surfaces of glass windows by an authorized dealer. They include a 10-year commercial warranty that covers bubbling, peeling, installation issues, and film issues.

3.2 Mid-Atlantic Service & Supply Corporation dba Commercial Window Shield: 8 Mil Clear Safety and Security Film

8 Mil Clear Safety and Security Film is offered in thicknesses ranging from 4 to 21 mm. The film is available in clear or in a variety of tinted, solar energy-reflective versions that conserve energy. Some of these films are highly reflective and have a mirrored appearance, and some are a neutral grey color. All window films block 99.9 percent of UV rays.

These films have been tested per GSA open-air bomb-blast testing standards, Dade County (Florida) requirements for windstorm protection, and for impact-resistance. These films can also be physically anchored to the window frames to provide a stronger system. There is a 15-year manufacturer’s warranty against defects in the film.

3.3 Service Group Distribution: Pentagon Safety and Security Window Film

Properties and specifications for Pentagon Safety and Security Film include:

- Available in both clear and solar control versions
- Thicknesses ranging from 4 to 15 mm
- Optically clear
- Advanced adhesives
- Impact resistance and certified performance
- 10-year manufacturer's warranty.

Pentagon Safety and Security Films have been tested to standards in the industry for bomb blasts, wind storms, and debris impact. Pentagon's FT Series Safety and Security Window Films have been evaluated, tested, and certified in accordance with the following test methods/standards:

- ANSI Z-97.1 and CPSC 16 CFR 1201– Small missile impact test
- ASTM E1996 and ASTM E1886 – Large missile impact test and cyclic wind pressure tests
- GSA-TS01-2003 – GSA explosive test
- ISO 16933 – Explosive resistant security glazing
- ASTM E84 – Flame spread and smoke developed test.

Pentagon Solar Security Window Films combine the physical protection of safety films with solar control protection against the harmful effects of the sun. These films block up to 79 percent of solar energy, reducing air conditioning costs, eliminating hot spots, and reducing uncomfortable glare. Pentagon Security Window Films can be coupled with Pentagon Protection USA's edge retention attachment systems for increased protection.

3.4 Service Group Distribution: Hanitatek Safety and Security Window Film

Hanitatek Safety and Security Window Films come in two different models, SolarZone and SafetyZone. They protect against theft, storms and associated flying debris, blast events, and are resistant to graffiti. SolarZone Safe films also provide solar control by virtually eliminating UV radiation and reducing solar heat gain and glare. The SafetyZone safety and security films are optically clear and distortion free. This film is made with specialized polyester film with a transparent adhesive and meets ISO 9001 quality-assurance standards. In the clear version, SafetyZone films are available only in thicknesses of 4, 7, 8, 12, and 15 mm. Two SafetyZone film models can be used for exterior safety and come in 4 and 7 mm thicknesses. SolarZone and SafetyZone films have been tested to the following safety standards:

- EN 12600 – European glass-impact test
- ANSI Z-97 – United States break-safe test
- BS 6206 – British glass-impact test
- CPSC 16 CFR 1201 – United States break-safe test

- EN 356 – European test for resistance to manual attack
- DIN 52290 – German impact test using 9-pound steel-ball drop test
- GSA level C blast testing
- UL 972 – Standard for burglary resisting glazing material.

SolarZone Safe films combine the shard protection of SafetyZone security films with high levels of energy efficiency. They come in three different models: Cold Steel Safe, Silver Safe, and OptiTune Safe. Cold Steel Safe is a neutral gray film with solar energy rejection. It comes in 6 or 10 mm thicknesses with either 35 percent or 50 percent VLT for each thickness. Silver Safe reflective films have heat rejection, UV block, and reinforced protection of security laminates. For interior window applications they come in 4, 9, and 12 mm thicknesses. For exterior applications they come in only a 5 mm option. All of the films have 20 percent VLT. The 4 mm model of this film has been accredited to European Standards BS EN 12600 level 2B2. OptiTune Safe films have a neutral interior with a bold external appearance and have high levels of energy efficiency and shard protection. They come in 5 and 10 mm thicknesses, with 22 percent and 30 percent VLT, respectively. The 5 mm model has been accredited to ANSI Z97.1-2009 and CPSC 16 CFR 1201.

In general, SolarZone Safe films provide:

- Protection from glass shattered by impact, blast, crime, or natural disaster
- Excellent solar heat and glare rejection for enhanced comfort
- High levels of energy efficiency for reduced energy consumption and carbon footprint
- 99 percent UV block to cut fading and sun damage.

3.5 Solar Gard Saint-Gobain: Armorcoat Safety and Security Film

Armorcoat Safety and Security film protects against breakage due to accidents, acts of nature, attempted break-ins, vandalism, or bomb blasts. According to the manufacturer, Armorcoat's strong, resilient adhesive and flexible construction enable it to withstand severe levels of positive and negative pressure—allowing the film to move with the window should a blast occur, retaining dangerous fragments. It is made of a polyester film with a pressure sensitive adhesive that is applied to existing glass. It contains shards of glass during breakage, and if anchored to the frame, can maintain integrity of the building envelope. It can also be purchased with energy control coatings to minimize solar heat gain.

This SRWF comes in the following models: Clear (89 percent VLT), Silver Reflective (20 percent VLT), and Bronze. These films come in rolls that are available in widths of 36, 48, 60 and 72 inches, depending on the model chosen. The thicknesses of the films are 10, 14, 18, and 25 mm. The commercial warranty is 12 years. The manufacturer suggests the product be applied by professional installers. For high levels of performance, anchoring to the window frame may be necessary.

This film has been tested to the following standards:

- ASTM, E1886, E1996 (Hurricane)
- ASTM E84 – Flame and smoke generation
- ANSI Z97.1 and CPSC 16 CFR 1201 – Human impact
- GSA TS01-2003 – Bomb blast
- ASTM 1642-04 – Bomb blast
- ISO 16933 – Bomb blast
- EN 12600 – Human impact
- EN 356 – Burglary resistance.

GSA has approved Armorcoat Safety and Security Film for use to protect many government buildings and United States and foreign embassies. Special features include a version that offers radio frequency attenuation properties (e.g., 35 decibel average over a range of 30 megahertz to 10 gigahertz).

3.6 3M: Safety & Security Window Films Ultra S600 and S800

Ultra S600 and S800 clear window film are 6 and 8mm in thickness, respectively, and incorporate patented microlayer technology to provide strength and tear resistance compared with other films of similar thickness. It has an optically clear, UV-protected, pressure-sensitive adhesive on one side with a durable acrylic abrasion-resistant coating on the surface. These films contain at least 42 microlayers.

Ultra S600 and the S800 films combine sun control performance with safety features in virtually clear films. Clear films have a VLT greater than 84 percent. Sun control options come in Clear, Neutral, and Night Vision (soft bronze).

The films have been tested against the following standards: ANSI Z97.1, CPSC 16 CFR (Part 1201), GSA-TS01 (Blast), ISO 16933, and ASTM E84 (Flame Spread & Smoke Development). The films have a 10-year, 12-year, and 15-year warranty (depending upon the product) for product and installation when applied by an authorized 3M dealer.

These films can be combined with the 3M Impact Protection Attachment Systems that bridge the window film with the window frame and help enhance the performance of the impact-resistant window system. Often, attachment systems may be needed to enhance the performance of the overall system. Attachment systems are available at additional cost.

3.7 3M.: Safety & Security Window Films S70, S80, and S140

This series of window films is especially designed to fortify windows from blast-related attacks as well as accidental explosions. S70, S80, and S140 films can be combined with the 3M Impact Protection Attachment System. Some models also provide protection from flying glass in windstorms and seismic activity.

S70 and S80 are 7 mm single-layer and 8 mm dual-layer clear films, respectively, and are made with an optically clear, UV-protected, pressure-sensitive adhesive with an abrasion-resistant surface for durability. These films offer protection from break and entry, seismic activity, blasts, and have safety glazing and anti-graffiti properties. The S140 is a 14 mm triple-layered clear film made with an optically clear, UV protected pressure-sensitive adhesive with an abrasion-resistant surface for durability. S140 film has the best performance of all films in the 3M series and also provides protection against windstorms.

S70, S80, and S140 films have been tested using the following standards:

- EN 356, UL 972, ULC 332 – Break and entry
- ANSI Z97.1, CPSC 16 CFR 1201– Safety glazing, human impact, seismic, and spontaneous glass breakage
- ASTM E1886, ASTM E1996 – Windstorm and debris protection
- ASTM 1642, GSA TS01-2003, ISO 16933 – Bomb blast and explosion protection.

4. VENDOR CONTACT INFORMATION

Additional information on the products included in this market survey report can be obtained from the vendors listed in Table 4-1.

Table 4-1. Vendor Contact Information

Company	Product(s)	Address/Phone Number	E-Mail/Website
Absolute Perfection, Inc.	LLumar/Vista Safety and Security Window Film	5397 Enterprise Street Sykesville, MD 21784 410-549-4285	customerservice@aptinting.com www.aptinting.com
Mid-Atlantic Service & Supply Corporation dba Commercial Window Shield	8 Mil Clear Safety and Security Film	97 Old Greer Town Rd Taylors, SC 298687 864-268-0068	adam@commercialwindowshield.com www.commercialwindowshield.com
Service Group Distribution	Pentagon Safety and Security Window Film, Hanitatek Safety and Security Window Film	4080 N. Palm Street, Ste 803 Fullerton, CA 92835 714-773-0367	info@servicegroupdist.com www.servicegroupdist.com
Solar Gard Saint-Gobain	Armorcoat Safety and Security Film	8575-A Somerset Drive Largo, FL 33773 727-437-1033	nick.routh@saint-gobain.com www.solargard.com
3M	3M Safety & Security Window Films; Ultra S600, S70, S80, S140	3M Center, Building 235-2S St. Paul, MN 55144-100 800-3MHelps	n/a www.3M.com/windowfilm

5. SUMMARY

SRWF is often used to protect windows in critical infrastructure such as airports, transportation venues, government facilities, and other buildings vulnerable to attack. SRWF mitigates the effects of splintering glass if there were to be a bomb blast or other intrusion. When the glass breaks, SRWF holds the shards together to reduce the chance of injury to people. These films can also protect against windstorms and flying objects. The SWRFs in this market survey include films that can be used indoors and/or outdoors, have been tested against safety standards, and are in compliance with building codes. Other properties to consider when selecting SRWFs are that some models shield offices from harmful UV rays, block out the heat of the sun, and reduce glare in windows. Installation options usually include the ability to anchor the system to the frame of the window for increased security performance. Anchoring the SRWF to the window frame helps prevent the window from flying in or out. However, a simple application of the film to the glass of a window can also be used for infrastructure that does not require increased levels of protection.