EMI SHIELDING SOLUTIONS FOR DEFENSE APPLICATIONS

INTRODUCTION

The Aerospace & Defense industries have always been the main drivers for RFI/EMI shielding design and products. Achieving EMC (electromagnetic compatibility) in this sector is safety critical, whereas in everyday life it can just be a frustrating nuisance.

Aircraft can get struck by lightning with regular occurrence which will cause an electromagnetic pulse or EMP. EMP will have a devastating effect on electronic circuitry, so it is important that the aircraft has a path for the lightning to continue without causing damage. Space is another matter; satellites are in a very hostile electromagnetic environment with solar flares that can emit a coronal mass ejection. We are protected on earth by the magnetosphere, but satellites don't have that advantage, so shielding is paramount to ensure the safety of the satellite and its systems.

Greater integration of electronics means electromagnetic compatibility between systems is of upmost importance to ensure they work in harmony and not interfere with each other. Aircrafts are more fly-by-wire than mechanical systems, with complex software operating computerised systems. Sensors measuring the aircraft environment, flight data etc. all need to communicate with each other, operate independently and provide back up for system failure or malfunction.

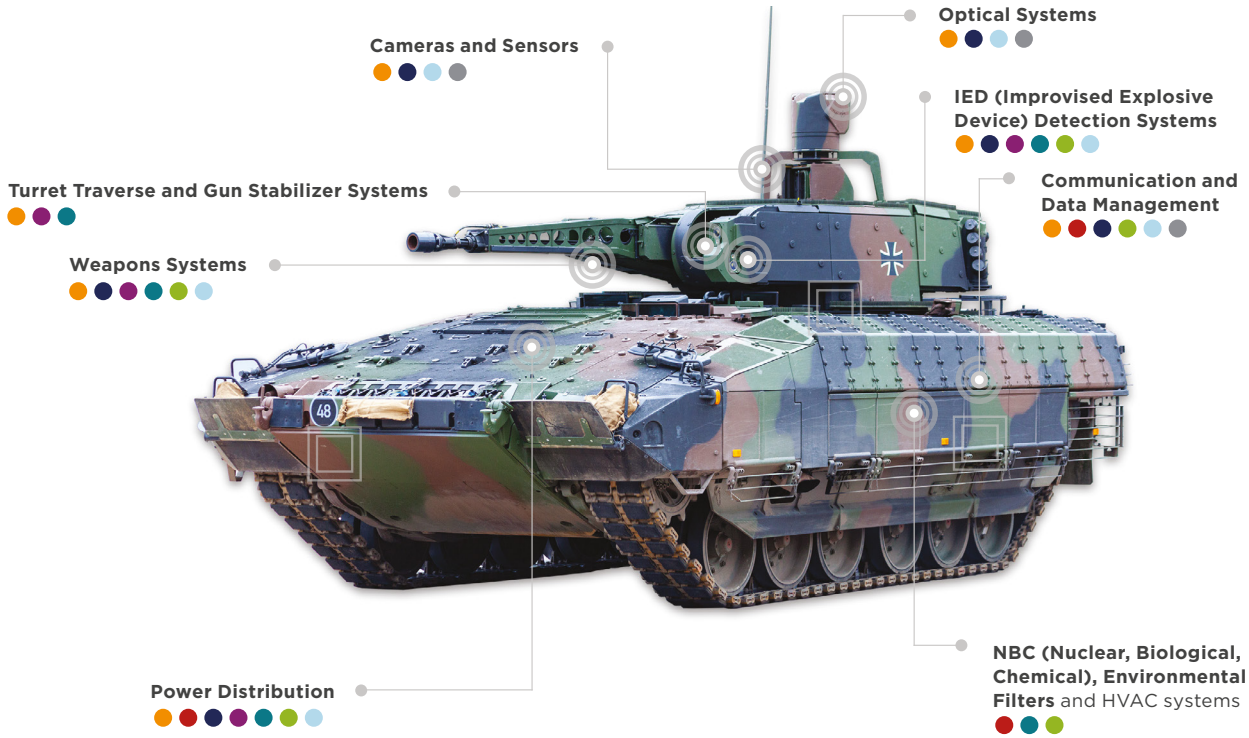
Electronics engineers are very familiar with this and will consider in their design good board layout, filtering, grounding, signal integrity etc. to try resolving EMI at its source. However, shielding of the enclosure is just as important and solves the problem of radiated emissions and susceptibility. Mating surfaces on an enclosure can look very flat and you think there is full metal to metal contact but, in a mass production process nothing can be that flat and gaps will exist. These gaps are slots and can become radiating antennas. This joint unevenness can be addressed by using an electrical gasket and adding more fixings to get good contact between the mating surfaces.

RFI/EMI shielding is a mechanical fix for an electrical problem and the enclosure design engineer should be aware of the types of gaskets available and their different attributes and ensure there is enough land area on the enclosure seams, doors etc. to fit the gasket. In Aerospace, weight and size of equipment and systems is important so miniaturisation where possible is used. This means that the shielding options available to the design engineers must also be small and offer good shielding. Electrically conductive elastomers are the best option for Aerospace as the material can be moulded, extruded or fabricated into very small components or deposited directly to hardware. Many electrically conductive fillers are available to suit shielding requirements and a fluorosilicone base meets the needs of resistance to fuel oils etc.

The aim is to always design for the worst-case scenario and consider shielding early in the design process as it is very difficult, if not impossible, to retrofit shielding to an enclosure that doesn't have the space to incorporate a shielding gasket or component.

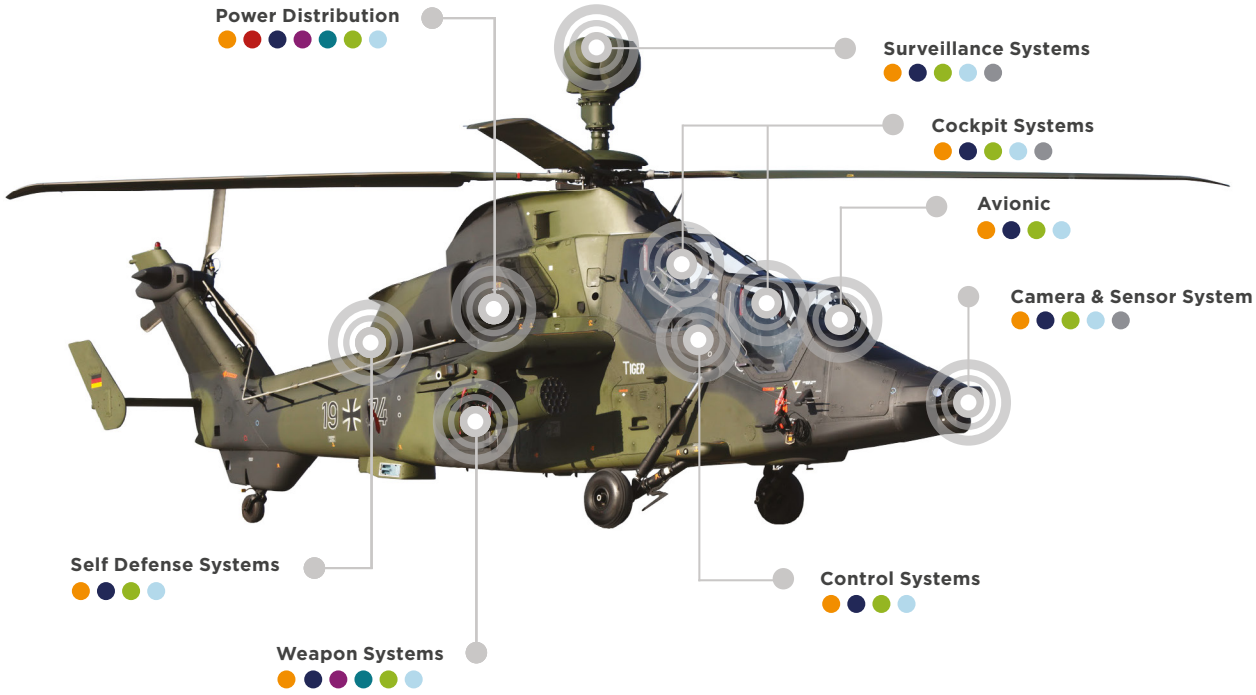
MILITARY TANK

Application Subsystems	Connector Gasket	Vent	O Ring	Knitted Wire Mesh	Knitted Wire Mesh with Elastomer Core	Oriented Wire	Jam Nut Seal	Shielded Window
Cameras and Sensors	●		●				●	●
Optical Systems	●		●				●	●
IED (Improvised Explosive Device) Detection Systems	●		●	●	●	●	●	
Communication and Data Management	●	●	●			●	●	●
NBC (Nuclear, Biological, Chemical), Environmental Filters and HVAC Systems		●			●	●		
Power Distribution	●	●	●	●	●	●	●	
Weapons Systems	●		●	●	●	●	●	
Turret Traverse and Gun Stabilizer Systems	●			●	●			



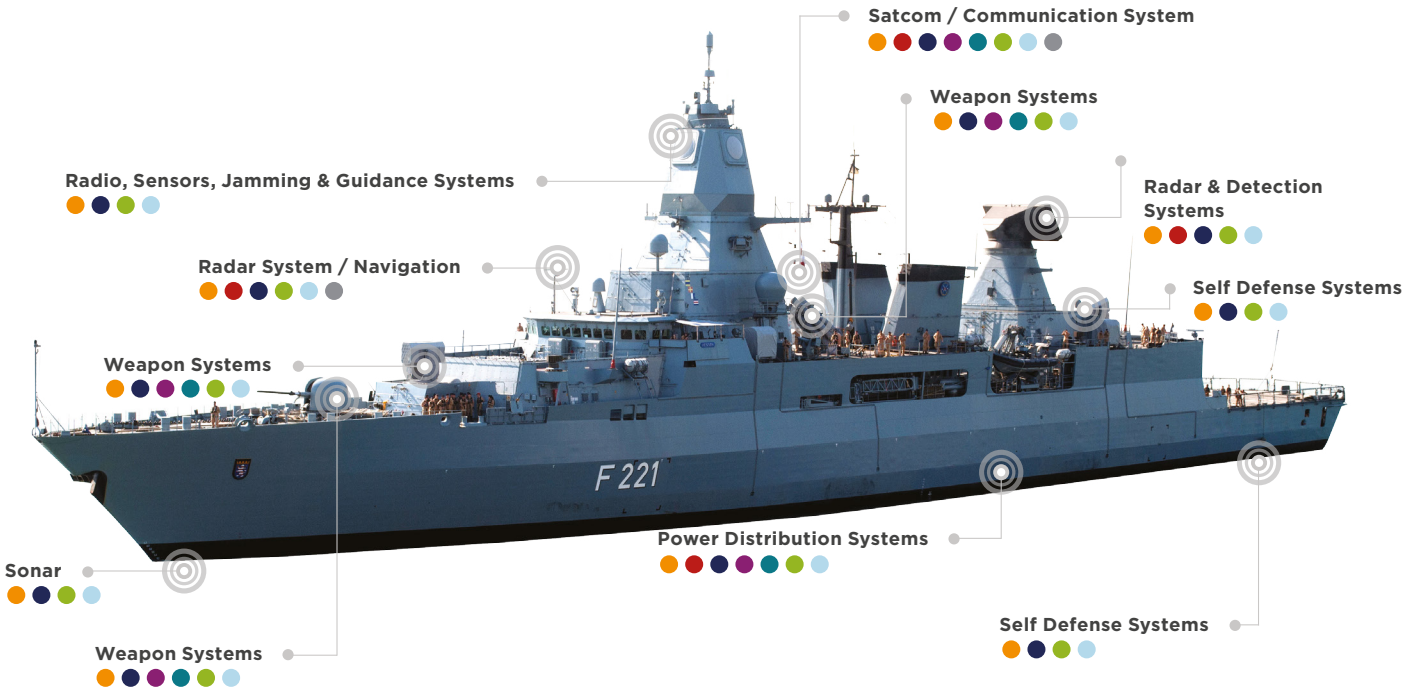
HELICOPTER

Application Subsystem	Connector Gasket	Vent	O Ring	Knitted Wire Mesh	Knitted Wire Mesh with Elasomer Core	Oriented Wire	Jam Nut Seal	Shielded Window
Power Distribution	●	●	●	●	●	●	●	
Self Defense Systems	●		●			●	●	
Weapon Systems	●		●	●	●	●	●	
Control Systems	●		●			●	●	
Surveillance Systems	●		●			●	●	●
Cockpit Systems	●		●			●	●	●
Avionic	●		●			●	●	
Camera & Sensor System	●		●			●	●	●



NAVY SHIP

Application Subsystem	Connector Gasket	Vent	O Ring	Knitted Wire Mesh	Knitted Wire Mesh with Elasomer Core	Oriented Wire	Jam Nut Seal	Shielded Window
Satcom/Communication System	●	●	●	●	●	●	●	●
Weapon Systems	●		●	●	●	●	●	
Radar & Detection Systems	●	●	●			●	●	
Self Defense Systems	●		●			●	●	
Power Distribution Systems	●	●	●	●	●	●	●	
Sonar	●		●			●	●	
Radar System/ Navigation	●	●	●			●	●	●
Radio, Sensors, Jamming & Guidance Systems	●		●			●	●	



PRODUCT PORTFOLIO

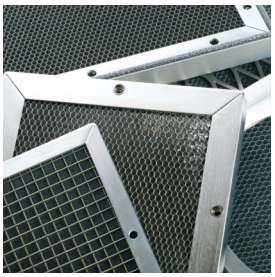
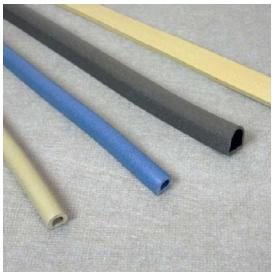
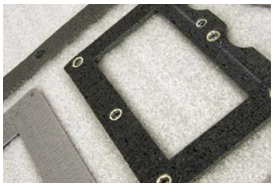
IMAGE	PRODUCT	DESCRIPTION	FEATURES/BENEFITS
	Connector Gasket	• Offering a wide range of gaskets to suit many standard size connectors which require an EMI/RFI gasket with optional environmental seals or sealing. • The choice of materials is vast and connector gaskets are available from virtually all of the flat sheet EMI materials.	• Meet standard sizes, MIL-C-81511, MIL-C-5015, MIL-C-38999 and common sub D connector gaskets. • Standard size stops and collars in standard materials are available, other sizes and materials are available on request. • The compression stop also ensures additional electrical bonding between the surfaces with a very low contact resistance. • Surface mounted gaskets are to be used where groove mounted gaskets such as O-Rings cannot be accommodated.
	Vent	• Aluminum Honeycomb Air Ventilation Panels consist of an aluminum honeycomb foil held in a rigid extruded aluminum mounting frame. • The foil, formed and laminated into a series of honeycomb cells that are glued and perforated or laser welded at the joint, ensures a conductive path at each joint. • TE offers Kemtron EMI Vent panels that are designed for use in electronic enclosures where good air flow is required for cooling and ventilation but where EMC compliance must be ensured.	• Honeycomb vent is series of tubes that acts as a waveguide, guiding electromagnetic waves into or out of the enclosure. • Offers high shielding performance, light weight and good airflow. • Consist of an aluminum honeycomb foil held in a rigid extruded aluminum mounting frame. • The foil, formed and laminated into a series of honeycomb cells that are glued and perforated or laser welded at the joint, ensures a conductive path at each joint. • Improved EMI shielding over air inlet/outlet apertures high shielding performance.
	O Ring	• O-Rings manufacturing methods include moulding or extruded sections that are cut to length and vulcanise jointed, these methods allow us to offer a range of solutions to meet your requirements with short delivery times. • Most of our conductive elastomer profile range is available as O-Rings in all conductive silicone & fluorosilicone grades.	• Moulding is a process that produces a joint-less O-Ring making it suitable in applications were a sheer force may be applied during compression. • Sections other than round are often better moulded as they lay flat keeping the correct orientation of the profile. • Good repeatable tolerances can be achieved with moulding. • Moulded rings are ideal where a small cross section or a very small inside diameter is required.
	Conductive Elastomer	• Conductive elastomers are fully cured silicones or fluorosilicone loaded with a variety of highly conductive particles providing superior EMI/RFI shielding performance combined with excellent environmental sealing. • The various conductive fillers are designed to ensure galvanic compatibility whilst providing low contact resistance between mating surfaces.	• Material options to provide required EMI performance and galvanic compatibility. • Provide low-contact resistance between connector and enclosure. • Highly conductive EMI/RFI gasket and environmental seal. • Performs in wide temperature range -55˚C +160˚C • Fluorosilicone for harsh environments: Fuel oils and solvents. • Flame retardant UL94 V-0 rating (molding grade only).

IMAGE	PRODUCT	DESCRIPTION	FEATURES/BENEFITS
	Knitted Wire Mesh	• A range of knitted wire mesh gaskets, providing a cost-effective solution to high shielding performance applications in the magnetic and electrical fields RFI/EMI and including EMP. • The mono-filament interlocking-loop construction gives strength while allowing it to conform to almost any size or shape. • The manufacturing process allows for an optional elastomer core to be included into the product to aid compression. • Knitted wire mesh over an elastomer core such as neoprene or silicone cellular profile or tube consists of 2 layers of knitting over the elastomer core but small sections 1.5mm diameter requiring only 1 layer. • The knitted mesh is then formed into the selected profile making a continuous gasket strip which is flexible and compressible and which makes an excellent RFI/EMI/EMP gasket.	• Solid knitted mesh gaskets provide an excellent EMI/RFI/EMP gasket shield between two metallic surfaces and with the choice of wire mesh material available allows for a good galvanic match with mating flanges, thereby limiting the possibility of corrosion between gasket and flange. • Knitted Wire mesh over an elastomer provides an excellent EMI/RFI/EMP shield. • Further, the elastomer core of the gasket allows it to be compressed using low to medium force conforming to uneven surfaces and recovering well after use.
	Oriented Wire	• Oriented Wire is a flat, sheet material, comprising a solid silicone rubber, embedded with Monel or Aluminium metal wires orientated perpendicular to its surface. Excellent RFI/EMI/EMP shielding performance is achieved as the material has a wire density of up to 140 wires/cm2 in solid silicone providing an environmental and RFI/EMI seal when clamped between two metallic surfaces. These wires are crimped to aid compression and are chemically bonded to ensure their retention.	• Contains thousands of thin monel or aluminium wires that pass through the sheets thickness. • A good solution for achieving RFI/EMI/EMP and environmental sealing in a single gasket. • Can be fitted with compression limit stops or collars. • Ideal for use as access panels, seals, connector gaskets etc. • Good conformity to allow for uneven surfaces. • Self-adhesive backing to allow for easy assembly.
	Jam Nut Seal	• Jam nut seals are compression moulded, and do not include a join like vulcanised-joined o-rings. • Moulding is essential where small cross section and/or small inside diameter is required. • If the O-Ring is to fit in a groove, it is important that the O-Ring does not over-fill the groove. • The cross-sectional area of the groove must be a minimum of 5% greater than the O-Ring's cross-sectional area. • Attention must be paid to ensure the closing force available will deflect the O-Ring to the required working height.	• Compression molded. • Compliant with MIL-FTL-38999, MILDTL-26482, MIL-DTL-81511. • Maintain the integrity of the seal Ideal where small cross section and/or small inside diameter is required.

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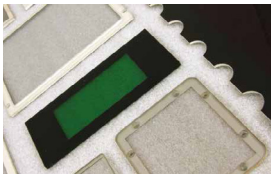	Shielded Window	• EMI shielded windows provide an EMI screen as part of a shielded enclosure which will provide protection against radiated emissions and susceptibility.
		• Shielded windows provide good transparency for viewing display devices such as LED, LCD, vacuum fluorescent, plasma etc and they can also form the front panel of an enclosure to provide impact protection, contrast enhancement of displays, display colour matching, anti reflection and an anti glare surfaces.
		• Large windows can provide transparent EMI shielding for architectural use such as computer rooms, shielded rooms, and secure communication cabins.
			• Shielded windows provide a high performance EMI shield while maintaining optimum optical transparency.
			• Screening or shielding of optical windows is achieved by using either:
			  • A very fine woven wire mesh trapped between or embedded in a clear optical substrate such as acrylic, polycarbonate or glass, or
			  • A transparent vapour deposited conductive coating such as Indium Tin Oxide or Gold applied to the surface of the clear optical substrate.
			• Termination of the window to the enclosure is achieved with a continuous low resistance conductive edge around the window, either a conductive buss bar and conductive gasket, or extended wire mesh (see window termination).

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Overcoming Galvanic Compatibility Challenges in EMI Shielding

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