Small Solutions, Big Impact

How Die-Cut Flexible Materials Solve Critical Aerospace Challenges

JBC Technologies

Discover how innovative die-cut flexible materials are transforming aerospace design—boosting lightweighting, enhancing durability, and unlocking new levels of performance.

When you think of aerospace innovation, what comes to mind is probably the image of a satellite silhouetted over the curvature of the Earth or the monolithic profile of rockets preparing for launch. Often overlooked are the small adhesives, gaskets, seals, joiners, fasteners, films, foams, and other intricate components that are crucial parts of the overall design.

From brightness mitigation to EMI/RFI shielding and custom gaskets and seals for electrical and thermal management, die-cut flexible materials provide lightweight, high-performance solutions to a range of aerospace challenges while boosting overall product performance. In an industry where weight, reliability, and performance are everything, die-cut components are mission-critical.

In this book, we'll cover:

- Important aerospace challenges solved through custom die-cutting and converting
- How die-cut components solve brightness mitigation, thermal and electrical insulation, EMI/RFI shielding, and vibration dampening challenges
- Strategies for optimizing costs without sacrificing performance
- How working with a converter is the key to creating the perfect custom solution for your project.

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LIGHT POLLUTION FROM LOW EARTH ORBIT SATELLITES

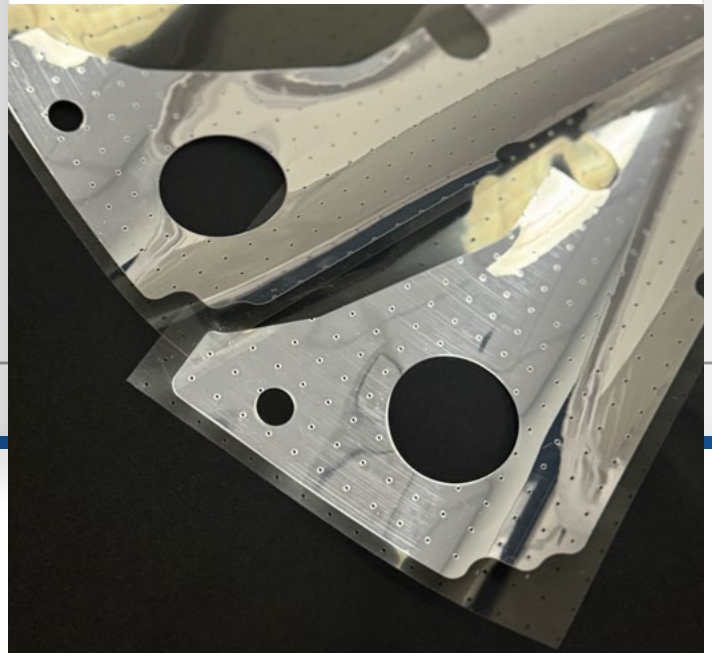
The Challenge: Artificial Illumination from satellite components or operations can contribute to background light, potentially interfering with sensitive measurements and obscuring the visibility of Earth's observers attempting to study the night sky.

The Solution: Die-cut brightness mitigation panels deflect solar rays from earth, eliminating the satellites' visible footprint while reflecting or absorbing specific wavelengths to maintain optimal thermal conditions.

Bright, reflective films like aluminized PETs, FEPs with silver Inconel®, and polycarbonate films with silver coatings offer an ideal balance of low weight, high flexibility, excellent UV and thermal resistance, and low outgassing. But raw film is only part of the equation. To make these materials practical in your satellite design, they must be laminated with high performance adhesives and cut to exact geometry so they can be easily integrated into hardware layouts.

CONVERTING TIP:

Acting as an extension of your engineering team, a specialized converter like JBC Technologies provides engineering support throughout the material selection and design phase all the way to post-processing and automation initiatives.



MATERIAL SPOTLIGHT:

FEP (fluorinated ethylene propylene) films *can be coated with silver through physical vapor deposition (PVD) and topped with an Inconel® layer. In addition to brightness mitigating effects, FEP with Silver Inconel® has great thermal and electrical shielding properties, which help direct heat away from the satellite.*

Learn More About FEP Films and other brightness mitigation materials in Performance Materials for Brightness Mitigation in Satellites

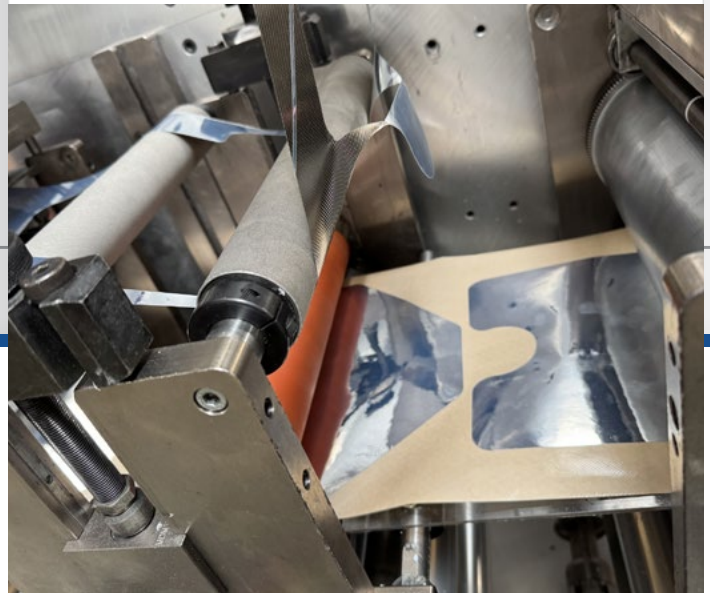
EMI/RFI

The Challenge: EMI/RFI disrupts sensitive navigation, flight control, and communication systems—all mission-critical systems that frequently inhabit tight compartments with irregular shapes where traditional metal shielding options are less than efficient.

The Solution: Flexible die-cut components fabricated with specialized high-performance materials such as conductive silicones, PET and PCAG films, conductive fabric tapes and conductive adhesives can offer high EMI/RFI performance in a lighter package than traditional metal shielding options. Not only do these options solve the EMI/RFI issue, but they also contribute to lightweighting initiatives.

CONVERTING TIP:

High-speed servo driven rotary die-cutting enables efficient and highly precise production of advanced multi-layered EMI/RFI solutions—combining conductive foams, films, and adhesives and die cutting to the finished shape all in one pass.



MATERIAL SPOTLIGHT:

3M™ Electrically Conductive Adhesive Transfer Tape 9703 *is a low-outgassing Z-axis electrically conductive double sided pressure sensitive adhesive (CPSA) tape that helps enable devices to meet electromagnetic compatibility requirements.*

Learn more *about conductive transfer tapes, films and other shielding materials in Die-Cut Flexible Materials: Lighter, Scalable, Aerospace EMI/RFI Solutions*

HARSH THERMAL CONDITIONS. SENSITIVE EQUIPMENT.

The Challenge: Sensitive instruments, electronics, and other critical systems must be protected from overheating or freezing to ensure optimal operation and safety.

The Solution: Using vertically integrated converting equipment JBC Technologies transforms leading edge flexible materials including aerogels, ceramic fibers and composites, polyimide and polyester films, and even high-performance foams and elastomers into lightweight, high-performance parts that solve critical thermal management challenges in tight assemblies.

The converting process takes materials that in and of themselves have what some might call thermal management super-powers" and combines them into multi-layer parts with even greater advantages.

CONVERTING TIP:

When quality is critical, make sure you evaluate the tools in your converter's toolbox. Inline vision systems and process checks are important elements of a strong converter's quality management system. Vision systems detect edge defects, surface contamination, missing features, and a range of other defects in real time, allowing for fast feedback loops for process adjustments and traceability for quality audits.

MATERIAL SPOTLIGHT:

***Dupont Kapton® Films** are well-known for their dielectric properties, but their thermal capabilities are also crucial. While not as insulative as thick aerogel blankets, they effectively manage heat in confined spaces and can be used as individual layers or within complex thermal blanketing systems like multi-layer insulation (MLI).*

***Learn more** Kapton® Polyimide films*

ELECTRICAL PROTECTION FOR RELIABLE PERFORMANCE AND LONGEVITY

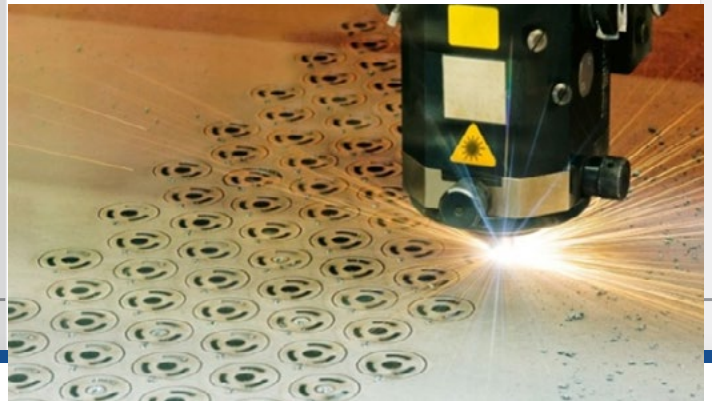
The Challenge: In space, systems are more compact, electronics are densely packed, and components must survive extreme temperatures, radiation, and EMI exposure. At the same time, engineers face aggressive timelines, weight constraints, and the need for scalable, modular builds.

The Solution: High performance materials, custom converting, and agile responsiveness.

Specialized materials like polyimide films, flame-retardant polypropylene, FEP, PET, PTFE, and PEEK are engineered for high performance in harsh aerospace environments. However, it takes custom converting processes like precision die-cutting and lamination to unlock their full potential. Consider the added benefits of combining one performance material with another for enhanced thermal stability and fire resistance—or of receiving custom multi-layer parts die-cut to your specific tolerances, kiss cut to a roll and ready for automated assembly.

CONVERTING TIP:

When the question is “what can you do, how fast can you do it?”, digital dieless cutting is the go-to. Not only does it enable rapid prototyping for fit, form, and function testing, helping engineers evaluate adhesive and material performance in real-world scenarios, it’s also a way to get short runs of production parts in your hands quickly. Eliminate the guesswork, accelerate validation.



MATERIAL SPOTLIGHT:

***Formex™ GK** - Primarily used for internal, non-load-bearing electrical insulation and barrier applications, Formex™ GK protects sensitive electronic components from dangerous surges or arcing in high-voltage, tight-space environments without adding bulk or excess weight.*

It offers dielectric strength ranging from 2,200 volts per mil (0.005 inches) to 670 volts per mil (0.0625 inches), is non-hygroscopic, has excellent dielectric properties, meets UL 94 V-0 flammability standards, and features low density.

***For more** detailed information, read: Material Spotlight: Formex™ GK Insulation*

HARSH MECHANICAL VIBRATIONS

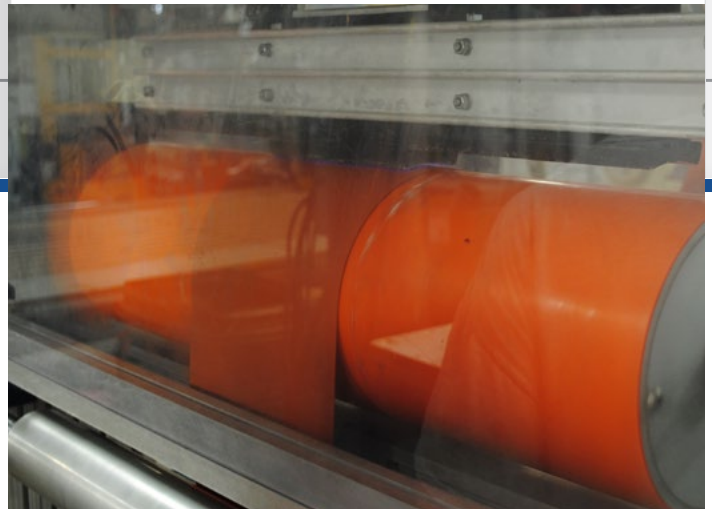
The Challenge: Aerospace systems face intense mechanical stress from launch to orbit. Vibrations from thrusters, engines, turbulence, and shock can damage sensitive electronics, optics, and structural components.

The Solution: Die-cut vibration dampening components absorb, isolate, and dissipate mechanical energy, extending the longevity of crucial aerospace systems.

When converted into gaskets, seals, pads, isolators, washers or adhesive backed strips, high-performance foams, elastomers, silicone gels, acrylic-based damping films and other specialty materials can be used to reduce vibration transmission. These viscoelastic materials can be combined with specialty adhesives and films for added performance.

CONVERTING TIP:

Plasma treating utilizes high-energy discharges to improve the adhesion and wetability of low-surface energy surfaces, like silicone rubbers, polyurethanes, and other viscoelastic materials. This process creates a radicalized surface, enhancing the reactivity of low surface energy materiasl to maximize their bonding potential and prevent delamination under intense mechanical stress. Tailored adhesion. Optimized performance.



MATERIAL SPOTLIGHT:

Norseal® F-20 Series *is a microcellular polyurethane foam designed for vibration isolation and sealing. Its soft, compressible structure absorbs shock while maintaining long-term resilience under load, making it ideal for gasketing in avionics and structural assemblies.*

Learn More *Norseal® Foam, F-20 (TDS) | Saint-Gobain*

REDUCING MASS WITHOUT COMPROMISING PERFORMANCE OR FUNCTIONALITY

The Challenge: As satellites and other craft are launched into space, every ounce of weight directly impacts launch costs, fuel efficiency, and overall mission success. Challenges like brightness mitigation, EMI/RFI shielding, insulation, and fastening solutions must be solved, ideally without adding excess weight, to boost performance and enhance the reliability of the entire aerospace system.

The Solution: Replacing traditional metal components like mechanical fasteners and fairings with die-cut flexible materials not only solves challenges like EMI/RFI, light pollution, and electrical insulation, they also contribute a greater system-level advantage. These lightweight, flexible components work together to elevate the overall system performance by alleviating unnecessary weight and bulk.

The JBC Advantage: Not just a die cutter. A partner in performance.

At JBC, we've heard time and time again that our customers want to keep their production lines as efficient as possible. That requires parts that can be applied seamlessly, without significant investment in skilled labor. This is where part delivery systems and part presentation come into play. Some of the more common delivery systems we use include kiss-cutting, through-cutting, pull tabs and extended-release liners.

Learn how JBC Technologies takes on the role as performance partner in this Case Study!

MATERIAL SPOTLIGHT:

Hexcel HRH-310 Nomex® Honeycomb *- Applicable for both acoustic and thermal insulation, Hexcel HRH-310 provides rigid structural integrity without the weight or bulk of traditional metal options. With a density of about 0.03g/cm to 0.05g/cm, Hexcel HRH-310 comes in well under aluminum's 2.7g/cm, overall weight without sacrificing structural integrity or performance.*

For more info *on Hexcel HRH-310, check out our blog highlighting this alongside other lightweight die-cut aerospace solutions.*

STRATEGIES FOR OPTIMIZING COSTS WITHOUT SACRIFICING QUALITY:

Part presentation is another important way that a converter can streamline production throughput without impacting quality. Optimizing the way a part is presented can have massive final assembly and downstream handling benefits.

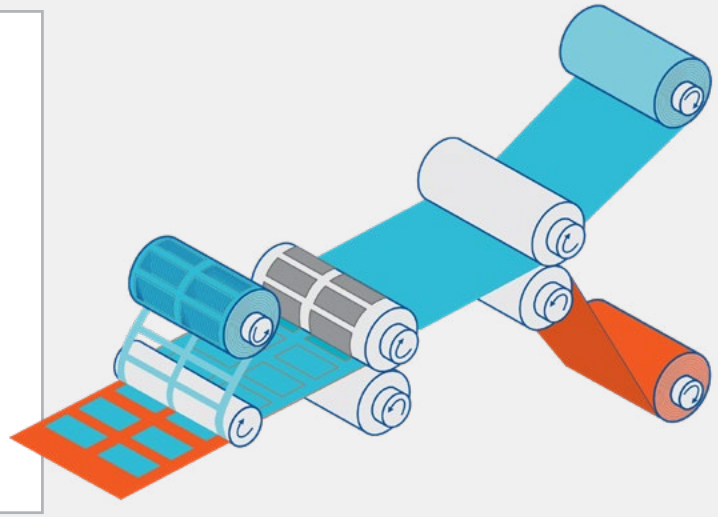
Gapping is the process of cutting parts without spacing and then transferring them onto a separate spaced liner. By butt-cutting adhesive parts with no gaps to maximize material yield, then transferring them onto a spaced liner for easier handling, a converter improves efficiency while reducing material waste.

Kiss-cutting keeps parts attached to the liner until they're needed by cutting through only the adhesive and stopping at the liner. By cutting just the material and not the liner, parts stay aligned and protected during storage and shipping, helping optimize them for post-processing.
Pro-tip: Pair with pull-tabs for maximum peel-and-stick ease!

Roll vs. sheet delivery: The way parts are delivered helps shape downstream handling. Rolls work great for high volumes of thinner, more flexible materials while sheets are best suited for lower-volume thicker materials. Rolls maximize automation but are only possible with thinner materials. Sheets allow for more material flexibility, but require slower, manual processing.

Pull-tabs are small extensions added to a part's design for easier removal and optimized post-processing. Without pull tabs, small parts can be a challenge to separate from their liners. Adding a pull-tab speeds manual assembly and consumer application- with minimal material investment. Just grab, peel, stick, and done!

Intricate island placement positions small, isolated functional components within a larger die-cut part. Islands are typically kiss-cut onto the material during the die-cutting process and remain embedded until the part is peeled or assembled, perfect for components like sensor contacts for proper electrical connection.



The result: Lean production, optimized performance, tailored for you.

SOLVING BIG CHALLENGES
WITH A CONVERTING PARTNER THAT WORKS AS FAST AS YOU DO

Die-cut flexible materials are effective, multi-functional solutions for many important aerospace challenges, but without a converting partner like JBC Technologies, they are just raw potential.

A 3M™ Preferred Converter, JBC Technologies provides precision die-cut solutions fabricated from highly technical engineered materials for leading manufacturers in the aerospace and space tech industries. With state-of-the-art rotary, wide web, and narrow web platen presses, along with dieless cutting capabilities and a range of ancillary converting functions, we are equipped to meet the rigorous demands of the rapidly growing space technology sector.

Built on a foundation of engineering innovation, supply chain optimization and manufacturing excellence, JBC adds value at every stage of our customers' project lifecycle. This can take many forms—from assisting with material selection to design for manufacturability, rapid prototyping, process development, and automated assembly, strategic supply chain solutions and value analysis/value engineering.

We embrace the idea that "failure is only a solution yet to be defined" and are committed to delivering quality, agility, and precision in every project.

Contact us today to get started on your next project.

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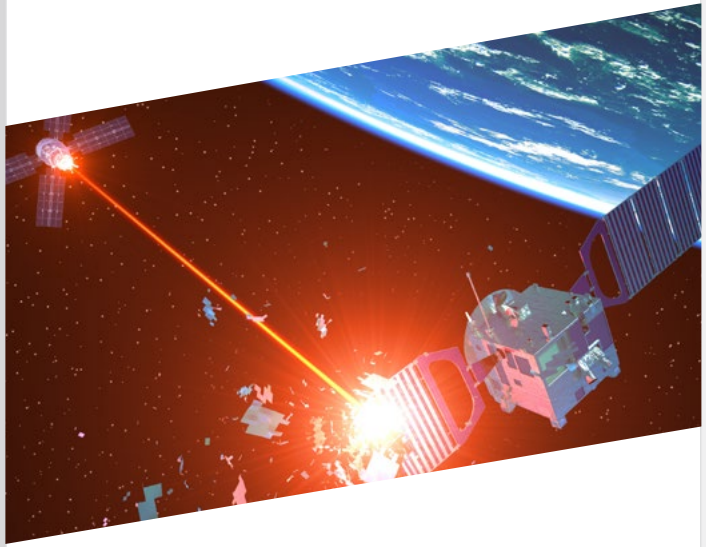
3M Preferred Converter Preferred

Empowering agile innovation in aerospace and new space with state-of-the-art converting and advanced material expertise.



Contact us today!

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