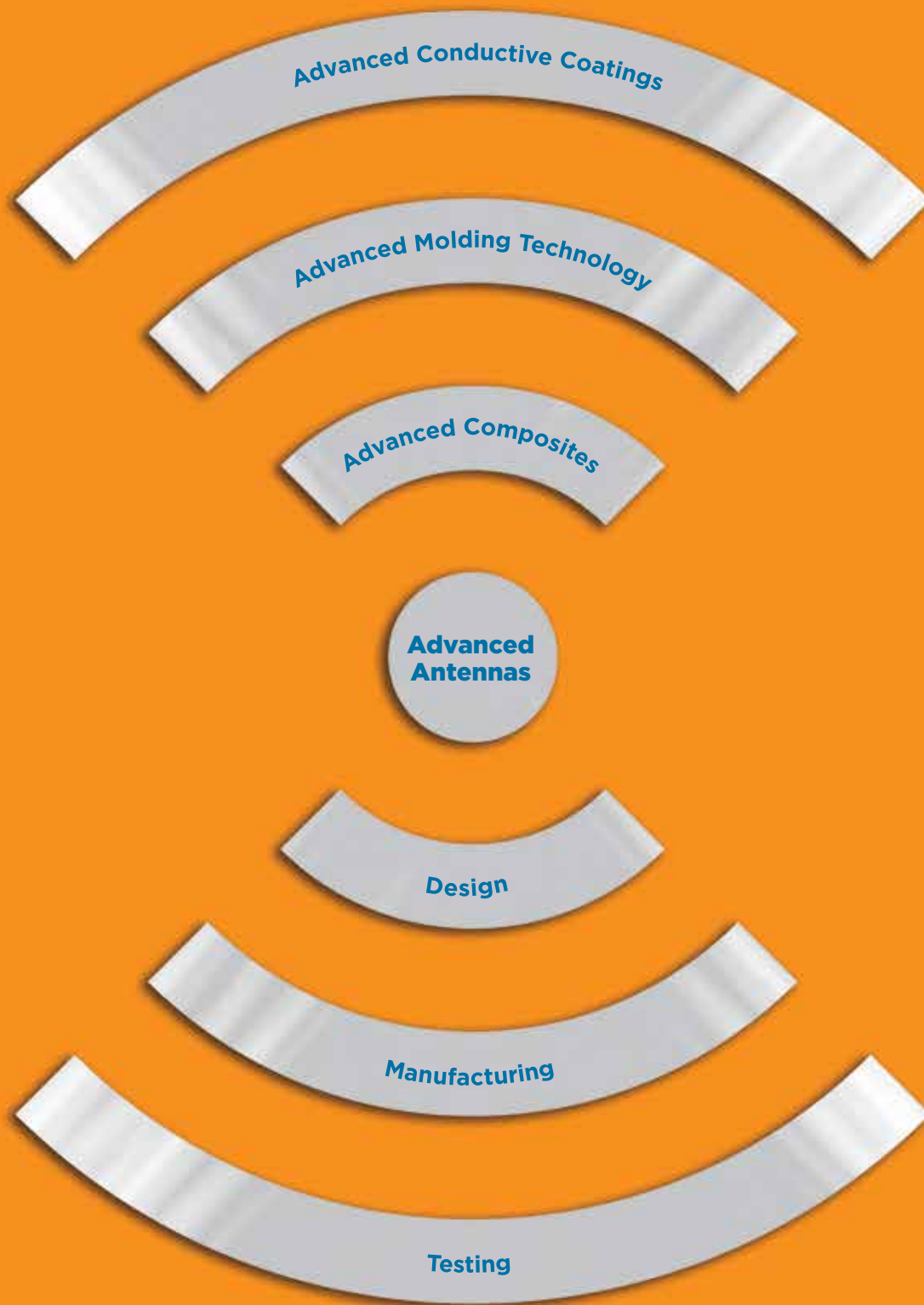




Antennas

For Aerospace and Defense

Applying TE's Leading Consumer and Composite Technologies to Deliver Lighter, Smaller Solutions for Harsh Environments in Aerospace and Defense



The Future of Antenna Packaging Begins with TE Today

TE's expertise in moldable composites, sophisticated metallization, and manufacturing yields advanced antenna configurations.

Save space and weight.

Achieve conformal designs integrated into your platform.

Reduce the number of discrete antennas with multifunctional designs.

Antennas

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APPLICATIONS

- Embedded antennas
- Conformal communications antennas
- GPS/GNSS navigation
- Phased arrays for signals intelligence and radar



Wideband Dual-Polarized Array



Conformal Vertically-Polarized Antenna

Expertise and Technology for Advanced Antennas

Established Leadership in Consumer Applications . . .

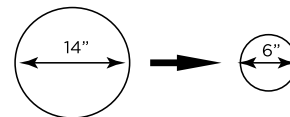
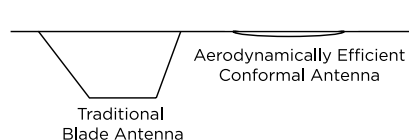
TE Connectivity (TE) is a leading supplier of standard and custom antennas for cell phone, tablet, laptop computer, home entertainment, and automotive applications—with over 500 million antennas shipped. As a leading supplier to mobile phone manufacturers, we offer antennas integrated in housings to reduce phone complexity, simplify manufacturing, and provide consistent performance.

. . . Brings Higher Performance and Increased Functionality to Aerospace and Defense

Our combined experience in consumer antennas, RF design, and military/aerospace markets allows us to create antennas that are smaller and lighter and offer excellent efficiency. We are helping designers create low-profile conformal antennas that can reduce drag in flight applications and create easier use in ground applications.

Meeting Your Goals for Next-Generation Antennas

- **Multiband, Wideband Antennas** yield fewer antennas per platform, but with each antenna performing more functions
- **Conformal/Embedded** with higher levels of integration into the platform for improved fuel efficiency and aerodynamics
- **Reduced SWaP** to create smaller, lighter, and more power efficient antennas that integrate seamlessly into the platform



Our novel antenna designs allow us to replace a 14-inch antenna array with a 6-inch array.

Advanced Technology for Advanced Antennas

Materials science is yielding new possibilities in antenna design.

We are using advances in technologies that are critical for tomorrow's advanced antennas.

Moldable Composites

We are creating composites that are light, strong, and resistant to harsh environments. We use a variety of carbon and glass fibers to customize the properties to match application needs. Equally important, we can mold advanced composites efficiently and cost-effectively. Composite enclosures can be 30% to 40% lighter than the aluminum enclosures they replace.



Because we compound our own plastics into composites, our expertise in additives allows properties to be optimized for application requirements.

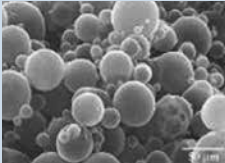
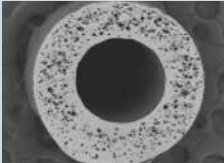
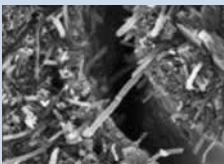
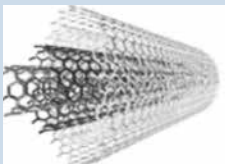


4- & 7- Element Multi-Constellation GNSS Antenna Arrays



Multi-Constellation GNSS Antenna

Our polymer scientists can create new materials meeting your design requirements. A typical thermoplastic composite begins with high performance engineered polymer to which glass or carbon fibers and other additives are included to enhance characteristics. Common specialty material requirements include enhanced strength, weight reduction, electromagnetic interference (EMI) shielding, fluid resistance, tolerance to extreme temperatures, color, and UV protection.

 Hollow Microspheres	 Foaming Agents	 Long Fiber Pellets
 Short Fiber Pellets	 Graphene	 Carbon Nanotubes

Requirement	Example approaches
Strength enhancement	Chopped glass or carbon fiber composites Continuous fiber composites
Weight reduction	Hollow microspheres Foaming agents Chopped glass or carbon fiber composites Continuous fiber composites
EMI shielding and electrical conductivity	Carbon fiber composites Nickel-plated carbon fiber composites Carbon nanotube composites
Fluid resistance	Engineered thermoplastics and coatings
Tolerance to extreme temperatures	Engineered thermoplastics

Injection molding offers a cost-effective means of creating parts with consistent features and performance. Internal investment has pushed our molding technology to new levels, enabling robust molded parts for harsh environments.

Our expertise in compounding materials and molding complex shapes allows you to realize value-added benefits:

- **Design for Composites:** we don't just replace aluminum parts with conductive composites, we design parts for ease of molding and higher functionality.
- **Part Functionalization:** we can integrate features into our molded parts, including DC and RF circuits, strain sensors, mechanical retention features, electrical connectivity, and even connector housings.



Application to Antennas

Composites and 3D selective metallization technologies offer paths to innovative antennas through:

- Reducing their size, weight, and cost
- Increasing design flexibility through 3D topologies
- Improving their manufacturability

Recent advances in long and continuous glass fiber composites:

- Reduce the necessity of the slow, tedious, and costly hand layups of traditional radome manufacturing.
- Enable the creation of stronger, thinner, and lighter radomes

Selective metallization through conductive coatings offers:

- Conductivity approaching that of bulk copper
- The ability to create 3D circuits, such as 3D RF couplers and direct circuit connections to antennas
- An attractive solution for EMI shielding, grounding, and lightning strike protection.

In addition to the other advantages mentioned, conductive coatings also offer the possibility of printing antennas directly on structural composite parts, such as body panels. This approach enables excellent integration of antennas into vehicles and platforms.

Selective Metallization

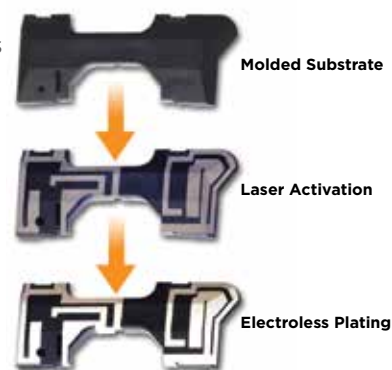
Our consumer antenna heritage brings us proven solutions for cost-effective selective metallization of three-dimensional parts. Our key processes include:

- Laser Direct Structuring (LDS)
- Conductive Coatings

Both selective metallization processes can repeatedly achieve traces and fine structures as small as 100 μm . These processes are suitable for creating three-dimensional antennas and traces on molded parts.

Laser Direct Structuring (LDS) is a three-step process.

- The substrate is molded in a standard thermoplastic molding process.
- A laser then etches the part to expose a specialized plating additive in the polymer resin.
- The substrate is placed in an electroless nickel plating bath, where the plating adheres only to the plastic that has been activated by the laser.



No mold or mask redesign is required to change the metallization pattern. A quick update to the laser path allows modification of the artwork design.

Conductive Coatings. Our coatings allow us to cost-effectively metalize arbitrary materials—including composites—for creating conformal antennas on nearly any shape. This 3D selective metallization process can be applied to a wide range of substrates – including plastics, chemically resistant composites, glass, ceramic, and metals – with acceptable adhesion, a temperature range from -65°C to $+200^{\circ}\text{C}$, and corrosion resistance.

The metallization is also durable and withstands shock, vibration, fluids, and salt spray to the levels typically required for aerospace applications. This process enables rapid development and manufacture of robust 3D antennas for harsh environments.



TE Components . . . TE Technology . . . TE Know-how . . .

AMP | AGASTAT | CII | HARTMAN | KILOVAC | MICRODOT | NANONICS | POLAMCO | Raychem | Rochester | DEUTSCH
SEACON Phoenix | LL ROWE | Phoenix Optix | AFP | SEACON

Get your product to market faster with a smarter, better solution.

LET'S CONNECT

We make it easy to connect with our experts and are ready to provide all the support you need. Just call your local support number or visit www.te.com/industrial to chat with a Product Information Specialist.

Technical Support

te.com/support-center

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Consult TE for the latest dimensions and design specifications.

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