

# KEY DRIVERS OF GROWTH ACCELERATION IN THE COMMERCIAL DRONE MARKET

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TE CONNECTIVITY'S INSIGHTS AND SOLUTIONS FOR ENGINEERS TO  
CAPITALIZE ON UAV MARKET TRENDS



### EXECUTIVE SUMMARY

With a global pandemic serving as a catalyst for increased drone use and a consumer drone market reaching its saturation point, the time is now to talk about the fastest growing segment within the global drones/unmanned aerial vehicle (UAV) market—commercial drones. Double-digit growth is expected in the commercial drone market, outpacing demand in consumer and government segments. Major players in the commercial drone market have conducted extensive R&D to drive technological developments, resulting in a launch of innovative products to propel market growth, particularly in the agricultural and construction industries. Currently, there are more than 750,000 commercial drones in use. By 2029, this number is expected to reach 17 million.<sup>1</sup>



TE Connectivity (TE), a world leader in connectivity and sensor technology, has taken a closer look at this market and is sharing insights to help engineers and manufacturers focus their design efforts to capitalize on the opportunity for innovation and to gain market share. Here's what engineers need to know about the global trends driving growth, UAV market applications, and technology and design challenges within the commercial drone market.

### Introduction to Commercial Drones

While significant opportunity exists in the drone market within the business and government spaces, it's important to understand industry/market trends, as well as existing and potential barriers for growth. The potential use cases and benefits seem almost unlimited as we look at the various ways these UAVs can function across industries. Drones can be used to carry and ship small payloads, deliver packages to homes or businesses, deliver needed supplies to hard-to-reach areas urgently, monitor or inspect large land sites and buildings, spray farmers' fields, monitor irrigation systems, and capture photographs and videos for both large and small events. As an engineer, you're probably thinking of additional uses within your industry, so let's look at the trends, opportunities, and barriers to consider when choosing or moving forward with your design.



### Commercial Drone Market Trends Driving Accelerated Growth

In February 2020, Business Insider estimated that commercial drone shipments will reach 805,000 in 2021, with infrastructure and agriculture predicted to gain the most value from drones over time.<sup>i</sup> From a regional perspective, Asia is the largest drone market today, driven by China and Japan with significant growth in India as well.

As the commercial market develops, it will mostly be based on inexpensive prosumer and mini UAVs and will be much more price sensitive than the governmental market. Even local law enforcement agencies will be buying mainly prosumer and inexpensive mini UAV systems rather than much costlier and larger UAVs. Also, there will be a considerable crossover between the consumer and the commercial unmanned aerial systems (UAS) markets, such as in real estate where some consumer drones are used for low-end commercial tasks. Consumer drone manufacturers are also creating more capable, complex systems able to take on more demanding commercial work, such as aerial filmmaking and field surveillance due to improvements in connectivity, picture quality, image stabilization and battery life as well as live-viewing video capability. However, consumer systems are predicted to reach their saturation point in the United States and Europe by 2024.

Below are the key drivers of growth in the commercial drone market today.

#### Impact of COVID-19

With businesses and people worldwide working remotely and social distancing due to the COVID-19 pandemic, the importance, convenience and efficiency of drone use is coming to the forefront, revealing drone applications that may be here to stay. Government agencies have also responded, such as in the U.S. where the Federal Aviation Administration (FAA) has expedited the approval process for services that help people,



Drones delivering medical supplies.

workers and communities stay safe and maintain social distance. The ability to promote social distancing and deliver much-needed medical items in a crisis is generating a more positive view of drones by these agencies and the general public, as well as helping accelerate the development and adoption of commercial applications, an extremely important boost for the industry.

Drones are being used to help limit contact between people (e.g. deliveries), disinfect facilities, deliver blood/medicine, and make deliveries to remote islands or areas without adequate infrastructure. Many companies are experimenting with drones for food deliveries, packages and urgently needed medical supplies. Delivery companies and pharmacies have been using drones to carry prescriptions to a retirement community in central Florida. A golf course in North Dakota is using drones to deliver snacks to golfers out on the course. In China, DJI Innovations used its UAS to spray disinfectant over three million square meters in Shenzhen and is working to aid 1,000 counties to adopt unmanned spraying to combat the disease. In Ghana, Zipline is using its drones to deliver COVID-19 test samples. The pandemic has also driven demand in the energy segment, especially around inspecting renewables.

According to FORTUNE magazine, as of July 2020, about 60,000 developers were working on drone applications with one of the largest drone manufacturers globally.<sup>iii</sup> These applications include pipeline inspections, 3D mapping, as well as applications related to critical infrastructure and first responders. An attached speaker became a popular drone feature to limit personal interaction between police and other authorities and crowds, with drones flying over beaches, parks, cities and neighborhoods to monitor social distancing and ask people to move when crowds needed to be thinned out.

DroneDeploy, a drone software startup in San Francisco, said the number of agriculture flights tripled in the first three months of the pandemic in the U.S., and flights by companies involved in the construction industry were up 70%<sup>iv</sup>. Most companies have been seeing increases in demand for the same kinds of general applications they were already offering, with services often expanding into more industries.

#### Investments from Venture Capitalists & Major Technology Companies

A total of US\$2.6 billion in investments by venture capitalists were identified from 2012 to 2019 across the consumer and commercial drone markets.<sup>v</sup> The large, unified U.S. market, strong U.S. venture capital market and improving FAA rules combined to favor the flood of venture funding. As drone trends and market demand have become clearer, venture capital funding has been targeted toward fewer companies focused on areas such as drone delivery, security, and mining. Increasingly, this funding is shifting from hardware to software and services that will make existing drones more useful.

Intel and Qualcomm made numerous investments in drone companies through their venture capital arms, with Intel also

acquiring two drone companies. Sony participated in a joint venture to develop its drone for use in commercial services. Amazon and Google Wing separately have been working to make the drone delivery market a reality, developing prototypes and working to establish the techniques of enabling drone deliveries on a commercial basis.

Communication companies are interested in providing the infrastructure needed to operate large fleets of commercial drones, as well as using drones for their business purposes. For example, Verizon acquired a drone startup, and AT&T has been using drones since 2016 to inspect cell towers for damage, test the performance of its wireless network and detect cell tower interference.

This is just a sample of the significant investment that technology giants and venture capitalists are contributing to drive rapid progress and technological advancement in drones. Recent advancements in electronics such as cameras, mobile hardware, processors, microcontrollers, and advanced computing are modernizing the drone product portfolio. Potential applications across commercial sectors are widening due to the development of inbuilt measurement tools; annotation tools for calculating distance, volume, and area; and innovation in data processing and mapping (e.g. automatic ground control points (GCP) used for geo-referencing areas).

### Access to Airspace and Global Regulations

As drones become more useful across sectors, and especially as demand in the commercial market keeps increasing, we're seeing government agencies worldwide re-examine regulations for UAVs in airspace, which can help further accelerate growth in the market.

- **United States** – In the U.S., current criteria restrict small UAS from undertaking commercial operations, though some operators can request waivers. The [FAA announced new rules](#) at the end of December 2020 and is working toward granting greater flexibility in opening airspace to small and large systems, with work being done to provide waivers beyond these regulations and develop a body of expertise to open national airspace to UAS. This approach involves various certifications and regulations and is a work in progress.
- **Europe** – A lack of rules has hindered companies seeking to invest and develop business cases to address the European commercial market; therefore, a [common European Union regulation](#) was introduced in January 2021. The new European regulation establishes three categories based on risk—open, specific and certified. The goal is to enable the creation of a single European market in which pilots and equipment can move freely across member states to perform work rather than being forced to deal with varied national regulations.
- **Asia** – With sympathetic government regulations in China and even subsidies in agriculture, Chinese companies are building leading positions in agricultural UAS and delivery. In Japan, leadership is seeking to be flexible with regulations to

continue to promote drone development in other areas. They see drones as part of the Fourth Industrial Revolution and promise to push for rapid development. Singapore is making its mark by providing strong support to the development of UAS applications in the city state, promoting the integration of beyond visual line-of-sight (BVLOS) in Singapore's urban environment. Regulations for commercial drones require a drone pilot license as well as an operator permit and activity permit, regardless of the drone's weight.

- **Australia** – Considered one of the most advanced countries in the world when it comes to airspace access, Australia's Civil Aviation Authority last year approved 1,940 operators' certificates by June 2020, compared to 1,600 in the previous year.

### Development of the UAS Service Industry

The commercial UAS services industry worldwide is growing at an explosive rate. New cloud-based data analysis firms help lower the barriers to entry for both service companies and end-users (e.g. farmers) by helping with data collection and providing rapid analysis of the data collected based on certain algorithms. In the United States, France, the United Kingdom, Australia and elsewhere, most of the approved operators for commercial UAS are seeking to provide services to UAS users.

The services industry promises to grow for government UAS as well. Some organizations (including the U.N. and U.S. State Department) have surveillance or survey needs that might be met by UAS, but they may prefer to contract out to avoid the costs and legal restrictions. There are drone companies with years of experience providing UAS services to military customers in Afghanistan, Iraq and around the world.

### Other Factors Driving Market Growth

**Miniaturization** – As demand for more commercial applications increases, the miniaturization of computing power will become more important to enable a greater array of sensors—multispectral, radar, sonar, LIDAR and atmospheric detection— and other advanced technology in designs for drones two pounds and under.

**Awareness** – Public awareness of drone capabilities, especially in the age of the pandemic, is helping fuel growth. An increasing number of brands with different capabilities are crowding the market with new products. Awareness on the consumer side can help fuel ideas for applications and growth on the commercial side, and as production increases, drone prices are decreasing.

**Reliability** – Ruggedization of drones is needed to ensure connectivity and protect components from harsh environments. Reliability needs to increase to reduce crashes and fly-aways, which will in turn increase adoption rates and customer satisfaction. Ruggedization and reliability also go hand-in-hand with innovation, as they help enable drones to be used where they may not have been able to be used before (e.g. during and after wildfires and natural disasters).





Drone spraying field for disease, weed and pest control.

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### Industry Focus

The emergence of drone technology for numerous applications like aerial photography, agriculture, disaster relief and management, industrial inspections, logistics, environment monitoring, etc. is strongly supporting the overall economic development of various countries. Agriculture is one of the most prominent areas of innovation in which drones are likely to be used significantly around the world in the coming years. Architects, engineers, and contractors are widely adopting small drones for site analysis to create three-dimensional prospects for project completion. The aerial photography application segment is projected to account for a large share from 2020-2025. Over the next decade, the following sectors are predicted to hold the highest share in the commercial UAS market.

#### Agriculture

Agriculture promises to be one of the largest commercial markets for UAS over the next decade. The Chinese government's willingness to subsidize agricultural systems is a major market driver, and rural labor shortages in China and Japan (due to urbanization and aging population) have made rural acceptance of drone adoption easier.

Currently, the most prevalent use of drones in agriculture is spraying for disease, weed and pest control, spreading microgranular pesticides and fertilizers and even beneficial insects. Drones make spraying quicker and more effective, prevent exposure of a worker to harmful chemicals, and enable access to more remote, rugged areas. Using a drone to capture images is an application expected to grow and become larger than spraying due to the effectiveness in studying crop health, detecting plant stress early, identifying pest damage and irrigation issues, among other uses. Drone images are more immediately available than satellite imagery and provide greater resolution.

Beyond visual line-of-sight (BVLOS) operations are critical for many larger farms, but drones are still not allowed to operate BVLOS in the U.S. and many European countries either at all or without waivers. For example, in the U.S., the FAA allows public safety organizations to apply for BVLOS waivers.

#### Photography

General photography is appealing as a market because it usually requires less skill and less costly equipment than other markets. The photography market has emerged as one of the earliest developing and accessible drone markets and is estimated to reach saturation point earlier than other commercial market segments. It has several submarkets ranging from less sophisticated, such as real estate and weddings, to highly sophisticated such as filmmaking. The lower-end submarkets have the potential to bring many small UAS in to serve the market while more complex submarkets may require more costly mini UAS systems.

#### Construction, Energy & Insurance

Construction will be the largest of the inspection markets, and currently, the ten largest worldwide construction companies are studying how to integrate UAS or working to integrate UAS in their operations. Prosumer systems can handle simple tasks like roof inspections and mini-systems can be used to track progress on construction sites. Due to the shortage of workers in Japan, the government there is strongly pushing for the deployment of drones in construction as well.

Energy is emerging as an important area for commercial UAS, as inspections using UAS demonstrate extremely high savings as well as a reduction in risk to personnel. Multinationals are scaling up their drone operations even though there are some areas (transmission line and pipeline inspection) that will take more time to develop due to the need for BVLOS capabilities.



Deliveries of documents, high-priority packages and even needed inputs for factories are prime targets of opportunity for drone delivery.

Insurance is an area in which large enterprises may have fleets of drones—including drones for roof inspections (prosumer systems) and for post-hurricane/disaster inspections (mini-systems). The number of mini-systems is expected to be considerably smaller than prosumer systems.

### Delivery & Communication

As noted earlier, the COVID-19 pandemic has helped improve the prospects for deployment of delivery drones. Deliveries of documents, high-priority packages and even needed inputs for factories are prime targets of opportunity for drone delivery. The full promise of the delivery market will only be met once access to national airspace is freely available which will be realized in 2029.<sup>vi</sup>

The economics of widespread use of the delivery UAS depends on the regulations/restrictions in terms of payload capacity, flying in urban areas, flying BVLOS and other safety concerns like theft and system hacks.

Additionally, the market for low-cost high-altitude pseudo satellites (HAPS) appears to have both the investment and applications to emerge as a major new market. HAPS aircraft will be designed to stay in the air for months, powered by solar cells. The primary market will be to provide internet to areas that are currently not served.

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### Barriers to Entry, Challenges for Engineers & Manufacturers

As attractive as the commercial drone market is, there are significant challenges and uncertainties still to be resolved. Despite this market's rapid growth, there are few companies making a profit at this early stage. The massive number of

**“ONE OF THE BIGGEST CHALLENGES IS THE LIMITATION OF POWER DENSITY OF THE BATTERIES, WHICH ULTIMATELY DETERMINES HOW LONG THE DRONE CAN BE IN THE AIR”**

— Qualitative research respondent, TE Connectivity

startups and investments by existing companies has created capacity that outstrips demand, driving prices downward. As companies are forced to evolve quickly to deal with intense competition, consolidation promises to accelerate in the industry. The Teal Group anticipates that well over half of the companies now involved in commercial drones will be out of the market in five years.<sup>vii</sup> In addition to this fierce competition, the following challenges also add some uncertainty to the market:

- **Airspace Rules** – With a lack of air traffic management by aviation authorities in various countries, progress in developing rules for airspace access could be jeopardized by major accidents or terrorist attacks using drones.
- **Rising Costs** – Some UAS manufacturers are concerned that the requirement for detect-and-avoid technology could raise the cost of those systems and undermine their viability.
- **Industry Safety** – Safety concerns around drone operations, such as crashes due to improper handling and battery failure, necessitate strong requirements for skilled, professional drone operators.
- **Cybersecurity** – Safety and security issues such as spoofing of UAVs, thefts, hacking and UAVs being shot down is a serious issue that needs more attention as this market accelerates. Commercial customers also will demand UAS that keep their proprietary business information safe.

## Key Drivers of Growth Acceleration in the Commercial Drone Market

- **Privacy Issues/Regulations** – Privacy issues will have a direct impact on the use and applicability of UAS. For example, using drones for surveillance, even for identifying criminals, has seen strong resistance.
- **Cost-Effectiveness** – As the drone sizes grow, their cost-effectiveness appears to decline as large UAVs require a significant amount of logistical support and specialized operator and maintenance training.
- **Reliability** – The reliability of systems will be a serious concern for commercial users as many of the new systems being introduced to satisfy budding market demand are new and relatively untested.

These challenges can impede the full development of the market for UAS with government and commercial users. One thing is for sure, simply building a UAS is not enough—users expect data analysis and other service offerings and are looking for companies that provide complete solutions.

## Commercial Drone Technology & Design Requirements

### Physical Attributes

There are essentially three types of aerial platforms on which drones can be based:

- **Fixed Wing** – Fixed wing drones are designed with wings similar to airplanes and often look like mini jets. They require either a launcher or a “runway” (open area) to take off and then need to gradually decrease altitude and land or can use a parachute or net to drop to the ground safely. Depending on how they are powered, fixed wing drones can fly for hours at a time and are ideal for applications such as mapping or surveillance that require a long distance, such as power line or pipeline inspections. Some on the market today, especially those used in military applications, can fly for 20-45 hours at a time.
- **Rotary Wing** – Rotary wing drones look more like helicopters and come in single rotor or multirotor platforms:
  - **Single rotor:** These drones typically look like mini helicopters with one large rotor at the top and a smaller rotor on the tail. They are more efficient, more stable and have higher flying times than multi-rotors, but they also require more skill to fly and have caused fatal injuries due to the large rotor blade. Single rotor drones can carry heavier payloads and are used for aerial laser scanning and surveying.
  - **Multi-rotor:** These drones typically have a body in the center and then 3, 4, 6 or 8 rotors extending atop arms from the body. With limited flying time and speed, these drones are not suitable for large-scale commercial applications but can be easy to use for aerial photography and video as well as small-scale aerial surveillance. They are also easy to operate, less expensive and easier to manufacture than other drone types.
- **Hybrid VTOL** – Hybrid drones are a mix of fixed wing and multi-rotor characteristics, which make them capable of vertical takeoff and landing (VTOL), even in small areas. This combination results in a more stable multi-rotor drone that’s easier to operate than a fixed wing drone and can fly

long distances. Their small high torque motors and powerful microcontroller help balance the payload movement during the flight time. Hybrids are expected to be the fastest growing type of drone through this decade.

### Technology Requirements

Engineers designing commercial drones and UAS need reliable, rugged solutions that enable power, sensing and data connectivity for multiple advanced functions as well as safety and security. Technology considerations include the following:

#### Sealing Components

To ensure reliable operation and high performance, sealing and protection are needed for use in harsh environments. IP-rated water-resistant connectors and heat shrink tubing are designed to protect components and connections from harmful fluids, moisture and chemicals.

#### Reliable, Durable Connector Solutions

For operating in high temperatures and at high power as well as vibration, locking latches and other terminal position assurance (TPA) accessories can be used to ensure mating and prevent contact backouts. Polarized housings can also be used to ensure proper plug-to-cap mating.

#### Miniaturized Components

Weight is critical in drone design. Smaller components and low profile options save valuable space on and above the PCB board and allow for greater functionality in tight spaces. Look for components with compact centerlines and smaller construction sizes (height).

“THE NEED FOR MINIATURIZED COMPONENTS IS CRUCIAL. THE ROLE OF SIZE AND WEIGHT FOR DRONE APPLICATIONS IS PARAMOUNT AND THIS WILL CONTINUE INTO THE FUTURE”

— Qualitative research respondent, TE Connectivity

#### Data Connectivity

High-quality omni-directional wireless transmission can be enabled in a wide variety of frequencies, including but not limited to Bluetooth, 5G, WLAN, cellular and Zigbee bands. RF coax connectors transmit analog signals while minimizing radio



## Key Drivers of Growth Acceleration in the Commercial Drone Market

frequency signal losses. Machine learning and artificial intelligence solutions can be used to manage large amounts of information and data collection from millions of data points, which is important for drones designed for more complex applications.

### Flight Certified and High Altitude Solutions

For safety and security reasons, commercial drones must comply with numerous restrictions set by government agencies. Designing drones with these restrictions in mind will not only influence the success of the product, it will also help accelerate growth in the market. Because commercial UAS avionics must meet DO-254 standards, drone manufacturers must select components with extensive service history, necessary for certification. For aviation manufacturers, this means selecting vendors that can provide the necessary documentation and guidance for DO-254 certification.<sup>viii</sup>

Components must also be immune to configuration neutron single event upsets (SEUs). Neutron flux increases with altitude and can cause device malfunction and failure. Designs need to be resistant to such radiation-induced SEUs to maintain high performance and functionality at altitudes.

### Safety Features

Ergonomic features are becoming more and more critical for worker safety and efficiency on the assembly line—increasing reliability, work productivity and decreasing the risk of mating errors. Low insertion force connectors reduce the mechanical force necessary to mate or un-mate the connector. Fully insulated terminals and tubing options help prevent shock hazards, and glow wire caps, plug housings and headers can be used in applications that require meeting high safety standards.

## Drone Subsystem Design Considerations

When talking about UAS components and overall design, it's helpful to break the UAS down into four subsystems:

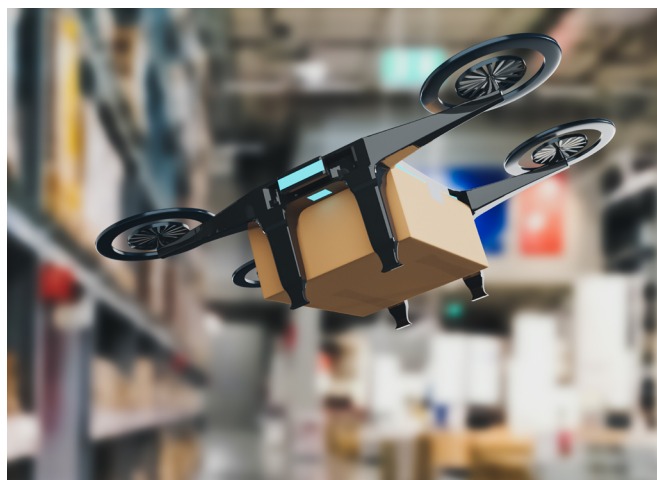
**Aircraft:** The first subsystem is the actual aircraft—the airframe, the platform (rotary, fixed or hybrid), the inertial navigation

system, motors, propellers, receiver and processor. The most common metallic materials to manufacture aircraft are alloys like aluminum and titanium, whereas nonmetallic materials include transparent and reinforced plastic. Multicopters have multiple brushless motors equal to the number of propellers, so a quadcopter would have four motors, for example. The electronic speed controller manages the power supplied to motor per command. The drones are able to fly in a particular direction and adjust their elevation by taking inputs from the inertial measurement unit (IMU).

**Ground Control Station:** The typical ground station consists of a wireless router along with a computer to capture, process and display data. This is the remote controller that communicates wirelessly with the drone.

**Data Link:** The data link is the communication channel between the aircraft sensors and ground control station. A wireless link, such as an IEEE 802.11 link, is used to enable communication between the aircraft's central data unit and the ground control station. For this purpose, routers equipped with omnidirectional antennas with high gain can be used to minimize path loss and make the signal-to-noise ratio higher.

**Payload:** This subsystem includes the accessories or payload relevant to the applications for which commercial drones are used, such as photogrammetry, cinematography, field mapping, digital elevation models, monitoring and surveillance. Examples include: UAV-compatible cameras such as multispectral cameras, thermal cameras, hyperspectral cameras, digital cameras and film imaging units. Typically, cameras weighing less than 12 pounds are preferred for first-person view (FPV) applications, and a 12-megapixel camera is the minimum required for agriculture applications. While cameras tend to be the most common payload, commercial drone payloads can also include cargo, infrared sensors, radar or lidar, electro-optical systems and more. Humidity, temperature and pressure sensors can be used for weather drones. Cameras and/or loudspeakers may be used on public safety drones. Pesticide sprayers may be used on agricultural drones.



Drone delivering packages inside large facility.



Subsystems of Commercial Drones.



TE Connectivity has high-performing engineering solutions with proven reliability for drone applications.

### How TE Connectivity Leads with Quality Engineering Solutions

TE Connectivity (TE) has a broad portfolio of rugged and sealed connectors, terminals and tubing; a range of different sensors that have proven reliability and quality in uses across industries; and standard and customized antennas covering all current global cellular and LTE bands as well as active GPS/GNSS/Galileo/Beidou applications that need to send back data on position or timing.

Wireless connectivity for outdoor applications presents a number of challenges with many potential sources of interference and signal blocking, such as inclement weather, tall trees and buildings, and more. Our product portfolios are designed with extensive engineering expertise to provide our customers with high-performing product solutions meeting a range of connectivity challenges and industry requirements. Many of our products are suitable for the harsh outdoor environments in which commercial drones operate.

- **Connectors** – Designed to reduce application size while managing power usage and enabling increased performance in the harshest conditions. We offer IP67 rated sealing options and ergonomics-friendly connectors that are glow wire tested and come with optional TPAs and connector position assurance (CPA) for extra protection, with operating temperatures up to 110°C.
- **Sensors** – Whether you're designing drones that need to measure pressure, temperature, position, vibration, or humidity, our engineers can help bring your ideas to reality using intelligent, efficient and high-performing TE sensors proven in harsh environments.
- **Terminals** – TE's terminals are ergonomically friendly (low insertion force) and designed for high retention with optional terminal position assurance to stay mated under extreme vibration or shock such as drone collisions.
- **Antennas** – With the ability to maintain high-quality transmissions in wireless devices, our broad range of standard and custom antennas can transmit reliably using 5G, LTE, Cat-M, NB-IoT, GNSS, Wi-Fi, Bluetooth, V2X, ISM and LPWAN bands and more. TE has antenna design and manufacturing facilities worldwide, with testing capabilities in near- and far-field patterns, scattering parameters, specific absorption rate (SAR), vibration, humidity, temperature shock, salt fog, throughput and acoustics. The choice of antenna can be critical to a device's reliability and function, and since antennas are commonly embedded as part of the device they must be considered from the start of the concept and design process.
- **Board-level shielding** – With the growing demand for thinner devices with multiple antennas, higher data rates, and increased operating frequencies, modern mobile devices require better solutions for reducing or limiting the effect of electromagnetic interference (EMI). Board-level shields from TE are stamped one-piece and two-piece metal cages that help isolate board-level components, minimize crosstalk, and reduce EMI susceptibility, all without impacting system speed.
- **Heat shrink tubing** – Designed to perform in the most demanding conditions, TE's heat shrink tubing portfolio comes in a wide range of single-wall, dual-wall and specialty options that seal, protect, and insulate the components that require the most protection. Depending on the drone you're designing, you may choose tubing that is resistant to high operating temperatures, chemicals, water and fluids, and/or flames, such as for drones used to monitor wildfires.

As a global industrial technology leader, TE is a design partner that innovates alongside you, sharing our expertise gained from extensive cross-industry experience. We understand how connectors, sensors and other components work together and use this knowledge to optimize performance and create more connected, more sophisticated commercial drone designs to drive safety and reliability for current and potential applications.

Finding ways to solve customer design challenges while maintaining or increasing reliability and performance in harsh environments is just one of the ways TE lives up to its purpose of creating a safer, sustainable, productive and connected future.

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02/21 Original