and Afghanistan. A back-up power supply was designed to provide redundant guidance control in case of main system failure, enabling the UAV to glide to a safe landing. The back-up capability provided an ideal opportunity to deploy a new generation of high-power lithium metal oxide batteries.

Constructed with a carbon-based anode, a multi-metal oxide cathode, organic electrolyte, and a shut-down separator, TLM Series lithium metal oxide cells from Tadiran Batteries feature a high energy-to-size ratio. A AA-size lithium metal oxide cell, for example, delivers up to 2 Wh of energy with a nominal voltage of 4V, a discharge capacity of 1,100 mAh, and both 15A pulses and 5A continuous current.

Lithium metal oxide batteries also offer a 20-year storage life due to a low annual self-discharge rate (less than 1% per year). The little cells withstand extreme temperatures (-40°C to 85°C) and comply with MIL-STD 810G specs for vibration, shock, temperature, salt fog, altitude, acceleration (50,000 gn), and spinning (30,000 rpm). The components also meet UN 60086 standards for crush, impact, nail penetration, heat, over-charge, and short circuit.

To power the UAV's emergency recovery system, a 32V/480W custom battery pack and enclosure was developed using 96 AA-size lithium metal oxide batteries. The resulting compact power supply, including the metal enclosure, weighed 2 kilograms — a far less bulky option than a battery pack constructed of D-size primary lithium batteries.

High-energy lithium metal oxide batteries are currently being deployed in numerous applications, including avionics, ordinance fuses, missile systems, GPS tracking and emergency/safety devices, shipboard and oceanographic devices, automatic external defibrillators (AEDs), and surgical power tools.

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Digital Optical Comparator

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VISIONx's VisionGauge® Digital Optical Comparator 700 Series, featuring 5-axis inspection, has allowed aerospace supplier Paradigm Precision to improve the inspection process of its 16 different heat shields.

The heat shields, made of Single Crystal Super alloy materials, provide maximum strength and tolerance in the high-heat environment of turbine engines. Paradigm uses EDM drilling machines to drill the heat shield cooling holes, ranging in size from 0.016 to 0.076 inches. Hole quantities span from over 50 to nearly 400, at different locations and angles into the assorted heat shields. The cooling holes must line up precisely where the OEM specifies via CAD files and prints.

The company was originally using a Coordinate Measuring Machine (CMM) and pin gauges to perform part inspection to ensure the holes were in the right locations. The pin gauges needed to be positioned perfectly or else the CMM probe could deflect off the pins. However, because the holes are so small and the angles of the pin gauges so precarious, they could not use the CMM to directly probe the holes and the CMM was unable to validate hole sizes below .030 inch.

The CMM inspection process was also awkward, taking Paradigm inspectors up to six hours to fully inspect 365 holes on one part. To reduce inspection time, they were measuring just two holes per side using Mylars™ to determine if the checked cooling holes fell within an acceptable range. Paradigm Precision determined that this inspection process was not accurate enough nor acceptable, so they researched inspection options that didn't include contact probing.

The VisionGauge® Digital Optical Comparator 700 Series enabled the viewing of heat shield holes from all sides and angles. Unlike the CMM, which only rotated on the head, the VisionGauge could locate on the X-Y plane as well as the Z.

The 700 series has linear axes with 0.25-micron resolution and a 0.005-inch resolution on the rotary axis. For both round and shaped holes, the VisionGauge 700 Series automatically verifies precise hole presence and accurately measures hole location — typically achieving repeatability of ±0.0001 inch.

The VisionGauge 700 Series requires no contact with the parts, which reduces the risk of marking or material deformation. The digital optical comparator also works directly with the parts' CAD data and does not require any overlays, Mylars, or templates, which can result in increased errors.

Paradigm inspectors now view the heat shield holes in 20x optical magnification in a 38-inch diagonal image viewing area, which allows them to easily and accurately locate holes in all different angles. Furthermore, the VisionGauge Digital Optical Comparator allows users to compare a part to its CAD data in real time, fully automated, which eliminates human error and speeds up the process of the hole inspection.

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