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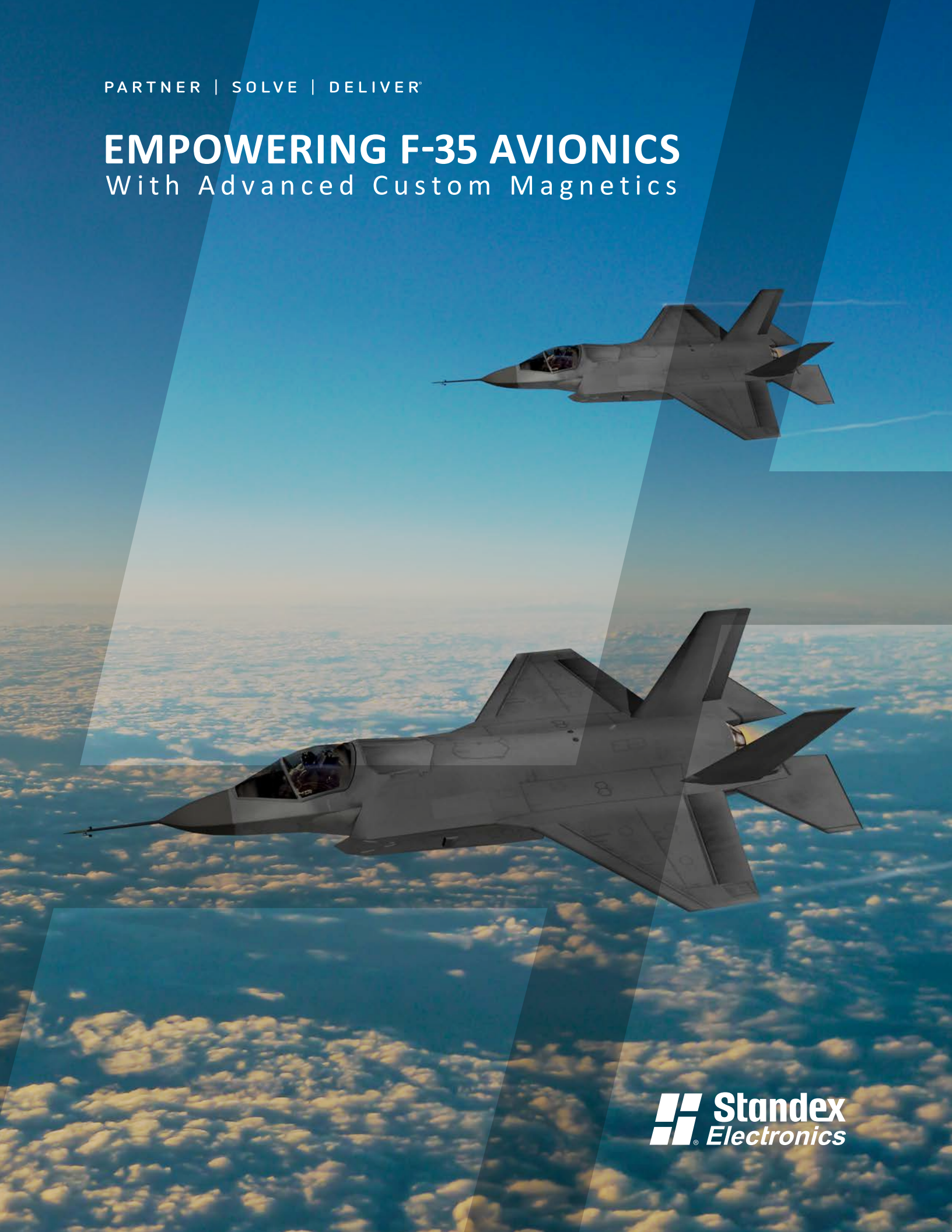
EMPOWERING F-35 AVIONICS

With Advanced Custom Magnetics



Standex Electronics

Figure 1: The F-35 helmet is a combat workspace, able to display mission-critical information while providing enhanced situational awareness.

All The Software In The World Can't Help F-35 Mission Capability If The Hardware Isn't Optimal.

When it comes to advanced weapons systems and platforms, the latest being fielded today manifest the most functional and complex vehicles and aircraft ever created. However, for all of the next-generation software, sensor suites, and systems, there is still a critical requirement for reliability, accuracy, and efficiency. **One of the most overlooked aspects of advanced military systems are the electromechanical and other motion and sensing systems that need precision magnetics**.

For example, the F-35 is a phenomenal aircraft with some of the most advanced avionics on the planet. The helmet the pilot wears is a combat workspace, able to display mission-critical information while providing enhanced situational awareness of the battlefield, simply by the pilot moving their head (Figure 1). It gives pilots a 360-degree view of the aircraft's external environment without needing to change the aircraft's attitude in any way.

This level of situational awareness doesn't come easy. In order for the helmet system to function properly, routine maintenance is important, and in addition to pre- and post-flight fittings, the helmet is inspected every 105 days and has a 120-day fit check. The F-35 helmet combines a sensor suite, night-vision technology, and a

detailed display system, with targeting and line-of-sight tracking based on head movement.

The head-tracking system that follows where the pilot is looking in order to present the appropriate view relies on a magnetic field, with sensors on the helmet detecting changes in the field as the pilot's head moves. Early generations of the F-35 helmet had tracking that lagged behind head movement, although these issues have been addressed to date. This example stands, however, to underscore **the importance of precision magnetics in the performance of advanced systems in advanced aircraft** like the fifth-generation F-35.

Magnetics Everywhere

Beyond such things like advanced pilot helmet systems, military aircraft are full of mainstream applications that leverage magnetics. These systems range from fly-by-wire flight controls to the power electronics driving everything. The use of magnetic fields for motion, sensing, and power conversion are myriad and found throughout the aircraft. If the magnetics involved are not optimum for the application, mission capability is sacrificed, and performance is compromised.

In the case of mil/aero systems like the F-35, in addition to the needs of the application, every solution on the aircraft must also comply with regulatory and service requirements. These include meeting performance specifications like shock and vibration resistance, harsh-environment survivability, and long-range durability and service commitments. **Only an optimized, customized magnetics solution can meet such demanding needs**.

These demands require a solutions provider with sophisticated development tools like a destructive testing environment, for sub-systems going into aircraft like the F-35 that need to meet regs like DO-160, covering Environmental Conditions and Test Procedures for Airborne Equipment, a standard for environmental testing of avionics. These environmental requirements impact the design of every system, especially in the area of thermal management.

Thermal management is a key critical aspect of power design in military avionics power systems, as it is directly related to how a given system fits into the allocated footprint. Once any given sub-system is developed, it must also be optimized for the smallest footprint possible without impacting on the ability to move heat out. This requires significant customization of the power magnetics, as well as the magnetics in any of the related systems involved, such as motors and sensors.

Operational efficiency is another critical enabler, because any platform has a power budget for the entire system. Any sub-system cannot take more of that power budget than it is allocated, or total system performance suffers. When it comes

to the F-35, the primary systems impacted by potentially poor performance in the magnetics include radar systems, cockpit displays, landing gear, actuators, and other systems in multiple places throughout the aircraft.

Standex Electronics can address the needs of mil/aero systems with a diverse range of space-saving planar transformers and power magnetics for Military and Aerospace applications. The company has expertise in mechanical package design and how to have it perform reliably in harsh Military environments. Standex custom power conversion magnetic designs can also withstand thermal vibration and other military performance specifications, as well as providing high reliability and durability.

Standex can deliver high and low frequency magnetics, with solutions able to perform from 400Hz to RF, depending on configuration, with options such as automatic CNC, with toroidal hook and shuttle winding using 52-gauge to 5-gauge magnetic wire. Robust mechanical solutions include impregnation, casting, molding, encapsulation, and vacuum potting for high-voltage and other demanding applications. All magnetics are fully optimized using in-house MIL-STD testing according to AS9100.

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