



OMNETICS
CONNECTOR CORPORATION

Mission Possible

From hostile engagements over enemy territory to high-speed flybys that would make Maverick grin, every sonic boom and shimmering afterburner trail depends on one often-overlooked component: the connector. These small, unassuming devices quietly ensure every signal and every amp of power gets exactly where it needs to go, no excuses, no downtime. And that's no small task. Jet aircraft operate in some of the harshest environments imaginable, where failure is simply not an option. So, what role do these connectors play in high-stakes applications, and how does Omnetics turn demanding requirements into proven solutions?

The Challenges of Jet Aircraft Environments

Reliability is everything when it comes to connectors in jet aircraft, just a single momentary disconnect at the wrong time can compromise mission performance or even safety.

Achieving that level of reliability, however, is far from simple.

A high-G maneuver can physically pull connectors apart or cause intermittent disconnects, while constant vibration from engines, airflow, and weapons fire can loosen fasteners, crack materials, accelerate fatigue, and generate electrical noise as cables rattle against each other. Temperature extremes push materials to their limits, with aircraft often going from a baking desert runway to sub-zero edge-of-space conditions in minutes.

Low air pressure at altitude can cause materials to outgas or swell if not perfectly sealed, while naval deployments add salt spray and corrosion to the mix. Add in the possibility of being shot at, performing violent evasive maneuvers, and remaining combat-ready at a moment's notice, and the demands become clear: aerospace connectors must withstand extremes that most components never face. This is the baseline, not the exception.

Engineering the Impossible: Omnetics Solutions

When operating in the most extreme environments, generic connectors often aren't enough, and that's where Omnetics steps in.

Omnetics specializes in high-reliability miniature connectors, built with the realities of aerospace, defense, and other demanding fields in mind. Every design starts with the application, because the right solution in one setting may be the wrong choice in another.

Take high-shock and vibration environments, such as those inside a fast-moving aircraft or artillery system. In these cases, engineers will often choose traditional through-hole terminations over surface-mount. The extra soldered leads through the board provide greater mechanical strength, helping the connector stay firmly in place under sustained vibration or sudden acceleration. In contrast, surface-mount styles may save a fraction of a gram, but under extreme acceleration (tens of thousands of Gs in some munitions, for example), such connectors can shear straight off the board.

Corrosion resistance presents another set of trade-offs. Naval systems may call for stainless steel housings to withstand constant saltwater exposure. Alternatively, an aluminum shell with a specialized finish can provide both corrosion protection and color options such as olive drab, black, desert tan, or gray. Where weight is critical and corrosion resistance is required, titanium combines strength, low mass, and resilience in a way few materials can match.

In such situations where connector configuration requires extreme flexibility, Omnetics' in-house engineering teams rise to the challenge. With the ability to adjust shell materials, plating, pin configurations, and mounting styles, Omnetics can tailor a connector to suit specific environmental, mechanical, and electrical demands. Whether it's a multi-hundred-position nano connector for avionics or a compact interconnect for turbine housings, the aim is always the same: deliver a connection that works, every time. In environments where "mission impossible" is the daily reality, Omnetics makes reliable connections possible.

How Connectors Enable Jet System

Integrity

It's tempting to think the most common component in a fighter jet is the PGU-47 armor-piercing round, after all, it can shred a tank in seconds. In reality, the real workhorse isn't ammunition at all but the humble connector. Modern aircraft are essentially

flying electronic networks, and every system, whether navigation, propulsion, communications, or weapons control, depends on hundreds, sometimes thousands, of connectors quietly doing their job.

Cockpit Electronics

The cockpit is a dense ecosystem of electronics, including display consoles, helmet-mounted sights, flight controls, environmental systems, and life-support, all of which depend on secure data transmission and robust power delivery. In recent years, many programs have replaced traditional analog instruments with full-screen digital displays, enabling cleaner wiring and customizable pilot interfaces. But retrofit projects often mean integrating compact, lower-power avionics with legacy systems, which can introduce complexities.

In such environments, connector choice is critical. Traditional ARINC-style connector interfaces remain, while many choose to drive the size down utilizing MIL-DTL-83513 or MIL-DTL-32139 connectors. This heritage of rugged reliability now provides the 270 or fewer volts the flight system requires as they fly from sea level to 70000ft and beyond.

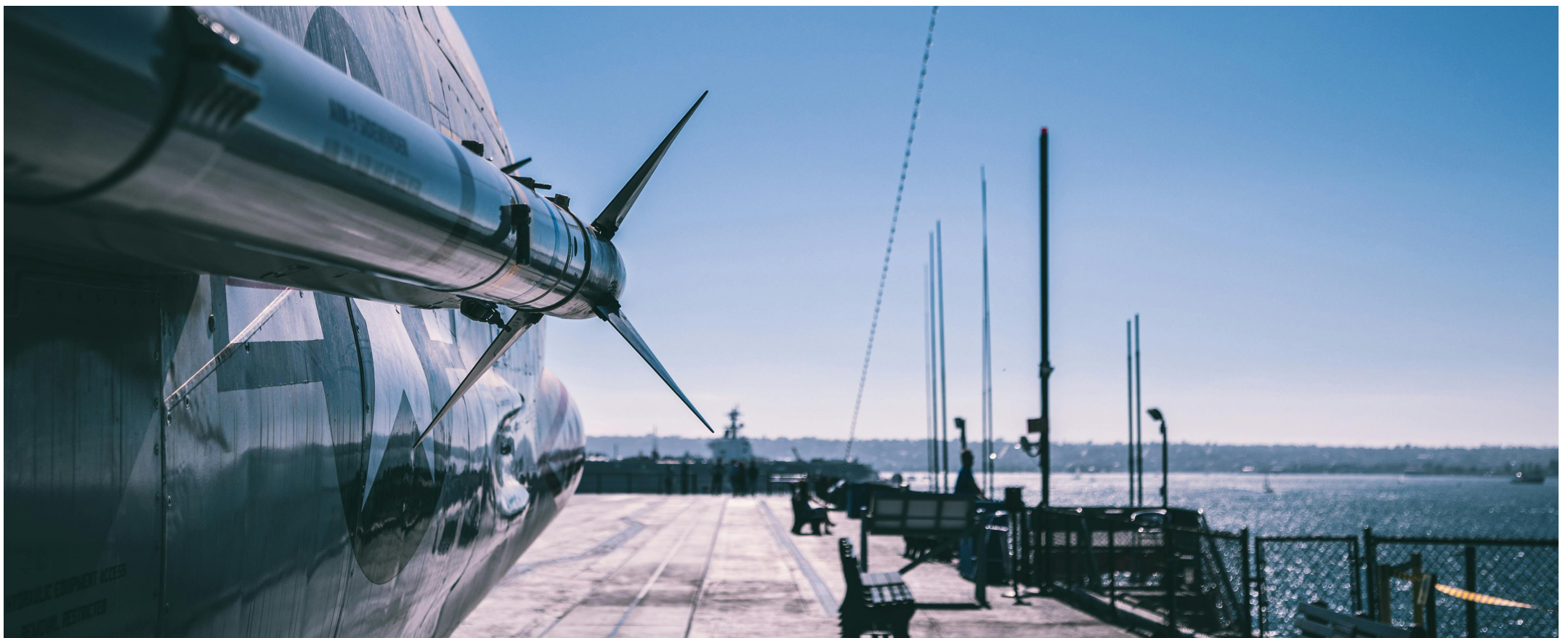
Engine and Propulsion

Two main requirements for jet engines circulate around the extreme temperature shifts as well as the shock and vibration from turbulence and operation. One minute, Maverick is sitting on the deck of the aircraft carrier near the Arctic or Antarctic, then, with full afterburner, being catapulted into the air. Minutes ago, sitting on the deck of a carrier in freezing salt spray; later, climbing through the sky with internal temperatures soaring past 200°C.

Buried in the details of that Arctic Volcano worth of temperature swing is Thermal Expansion, referred to as CTE or Coefficient of Thermal Expansion. Choosing material sets with similar or as close to identical CTEs is just one step in a journey of designing for application.

Communications and Electronic Countermeasures (ECM)

Modern combat isn't just about speed or maneuverability; information dominance is equally critical. Connectors in these systems deliver power and data for UHF/VHF radios, satellite links, GPS, radar, LiDAR, and laser ranging systems. In many applications, emissions in and out are critical to deliver the message to the appropriate party, or to obtain information others may not have.



Doing so discreetly requires a level of shielding to prevent stray signals from getting in or out of a system.

Shielding can be thought of like armor, as in layers that deter different types of signals. Lower speed or lower frequency may be able to be suppressed properly via conductive overbraids, with an additional ground to the airframe itself. Higher power or data rates may still see use of the overbraid, and between that and the wires themselves, find a conductive overwrap. Use of an additional wrap prevents escapement or intrusion of signals through any “holes” that may exist with a braid-only type of solution. Yielding a much more rigid, yet secure, transmission path for critical information.

Weapons and Targeting Systems

Weapons systems demand absolute reliability. Connectors link weapon release mechanisms, sensors, and targeting pods to fire-control computers managing precision munitions. Low latency and high signal integrity are essential; even a microsecond delay can throw off targeting accuracy.

These connectors may face shock loads from rapid maneuvers, recoil, or 300-G gunfire testing. Physical constraints may also demand rounded profiles, miniature harnesses, or blind-mate designs for rapid integration in tight spaces. In many cases this means securing methods are paramount. Weapon-mounted connectors are often referred to as panel mount, and the corresponding cable plugged into them employs backshells or strain reliefs in the form of machined parts, pour or injection molded types are frequently found on the wired side, all with the intent of reducing that vibration and load between the weapon and the wiring.

Power Systems and Redundancy

At the core of every subsystem is power distribution. Modern fighters employ increasingly complex electrical architectures, from auxiliary generators to emergency backups, all monitored by safety and load-management circuitry. Connectors in these systems must carry high currents safely while remaining compact and lightweight.

As such, redundancy is built in from the start. Some programs follow an N+1 rule; if four pins can carry the load when derated, the design uses five, while others share the load across multiple connectors, each capable of carrying it alone in case of failure. Con-

nectors used for these types have heritage, and testing for them has encompassed thermal rise, soak, elevation effects, pin-to-pin and pin-to-shell resistances, just to name a few. A main driver is operational ceiling, as the derating and redundancy mentioned earlier are now present.

Conclusion

Jet aircraft sit at the bleeding edge of engineering, combining extreme speed, precision control, and life-critical reliability into one platform. Every component is pushed beyond what most industries would consider reasonable limits, and still, it has to work every time. These connectors don't just survive heat, vibration, and pressure swings; they perform flawlessly under conditions that would destroy ordinary hardware.

Built for exactly this kind of environment, the company draws on decades of aerospace and defense experience, plus the ability to rapidly produce custom solutions, making it a trusted partner for engineers who can't afford failure.

Its latest connector innovations will be on display at DSEI 2025 (9-12 September, ExCeL London), offering engineers a chance to see how the toughest connector challenges in the industry are met head-on. These products aren't just components; they're the silent wingman, ensuring mission-critical systems remain connected, responsive, and resilient in the harshest conditions.

To learn more, visit [Omnetics Connector Corp.](https://www.omnetics.com)

