

# Going Beyond: How Better Power and Testing Solutions are Taking the Military and Aerospace Industry to New Heights



Demand breeds innovation. If there is one thing that defines the military and aerospace sector, it's the need for the latest and greatest in technology. Engineers in the military and aerospace industry are always pushing equipment past its limits to do something that has never been done before and break past the current limits of humankind.

In order to invent technology that hits harder and flies higher, engineers need better power and testing equipment. Advanced programmable power solutions offer a major advantage, as they can more easily adapt to changing power demands and electrical environments.

This white paper will focus on current challenges in the military and aerospace sector, along with key opportunities for better power and testing solutions.



## Rising Demands: The Military and Aerospace Challenges of Today

As the military and aerospace industry moves forward, several challenges have presented themselves, threatening to slow down or halt progress.

### Qualification and Standardization

When dealing with highly regulated and standardized industries like military and aerospace, one of the most important things is to "do no harm" to existing systems or processes.

For instance, every branch in the military has a high degree of qualification, requiring any new equipment or power solutions to fit to a standard tester. Not only do you have a test bench or test station, but you also have your Test Program Sets, or TPS.

A TPS is a collection of hardware and software, along with applicable documentation used for testing, fault detection and isolation, maintenance, and any other means of component and equipment evaluation within a unit under test, or UUT. Test programs are automated sequences used to provide controlled test environments and helpful operator instruction, along with:

- UUT stimuli
- Measurements of UUT responses
- Detection and isolation of UUT faults
- Alignment procedures for fault correction

The TPS is one of the biggest investments that the government has in these sectors. No matter what power or testing solutions you develop, preservation of the TPS is of paramount importance. Failing to do so adds risk and the potential of a huge requalification process that could waste countless hours and millions of dollars.

### Equipment Miniaturization

When it comes to the military and aerospace industry, smaller is almost always better. However, shrinking equipment is not as easy as scaling something down in CAD. Designs are often limited by larger, bulkier power supplies and electronic loads.

That is why a big challenge is figuring out how to shrink a power source without affecting its performance, behavior or reliability. The more you can condense a power supply, the more energy you can provide in the same volume, allowing for a smaller footprint in a depot or on a ship.

### Simulating Power Sources

In order to design better equipment and utilize higher technology system designs such as with lasers and radar, you need to be able to accurately simulate the power source. With the growing reliance on alternative and renewable energy sources, this means having to correctly and reliably emulate the natural behaviors that occur with renewable energy.

Military and commercial satellite testing is another great example. You need to be able to accurately emulate the power that you get from a solar panel and batteries, not just on the Earth's surface, but up in space. That means simulating the effects of shadows, orbital profiles, temperature extremes, and the aging associated with solar cells.

When you need to simulate a power source in these demanding applications, AMETEK Programmable Power's Battery String Simulator (BSS) provides safe, reliable battery power for complete integrated system testing. The battery behavior of the BSS is easily modified through a charge table to simulate any desired battery topology, including Nickel Metal Hydride, Lithium Ion, and Nickel Cadmium. AMETEK Programmable Power's Battery Solar Array Simulator (SAS) reproduces all possible solar array outputs, based on the wide variety of input conditions, including orbital rotation, spin, axis alignment and eclipse events. The SAS offers complete programmable control of all parameters that shape the solar cell I/V output curve.



### Key Power and Testing Considerations

With advanced power and testing solutions, leaders in the military and aerospace sector have the ability to drastically improve upon their technology.

#### Power Solutions

One of the biggest opportunities that you have with developing better power supplies and electronic loads for the military and aerospace sector is creating custom and more adaptive power sources. Since you need to avoid affecting the TPS at all costs, you must develop something that can perform better while still fitting in with established systems.

That is why a major opportunity for the industry is utilizing advanced programmable power solutions. With programmable power, voltage, current, frequency, transient response and many other characteristics can be tailored to fit the needs of a new system, while still remaining flexible and adaptable enough to maintain the integrity of the TPS.

With well-designed programmable power devices, it is easier to remain backward compatible and fit the needs of the established TPS. That way, you can focus on positive innovation while avoiding negative changes like causing a power supply to go outside the parameters of the previously determined test environment. This includes avoiding things like:

- Slower or faster transient response times
- Increased output noise
- Uneven power spikes

You must be able to keep your power sources adaptable and within acceptable ranges in order to work with cutting edge technology like advanced radar and imaging. If you want to be able to validate a system design that sees further and at a higher resolution, while still being able to adjust your focus and field of vision, adaptable power is required.

This is also true with lasers and high-energy weapons/tools. You need to be able to supply enough power to meet higher energy demands without overshooting the mark. If you overshoot on voltage, you can easily destroy the laser sources, rendering a critical tool or weapon inoperable and dangerous.

In addition to advanced programmable power solutions, developing compact, more efficient power supplies is a big leap forward for the advancement of technology in the military and aerospace sector. By shrinking a power source, you can reach the same power output at a smaller size, or drastically increase your power output without increasing weight/volume.

Research into GaN FETs and silicon carbide transistors is helping to move the miniaturization marker forward. This is especially great for radars, allowing you to shrink down bulky antennas to create more efficient arrays, or to increase range/power. Programmable power sources can be used to perform accelerated aging on new FET technologies to optimize the foundry processes and assure long life and performance.

## Advanced Testing

With the highly regulated environment of military and aerospace, having advanced testing equipment that can help with qualification is paramount. Highly precise measuring equipment is not just good to have but required. Of course, any testing equipment must be able to meet the standards of the TPS.

With any of the high-energy opportunities in the military and aerospace sector, you need to monitor your electrical environment closely to ensure reliable data and consistent results. Variation means risk, and risk could mean a breakdown in the field... or worse.

Another opportunity is automatic test equipment that can adapt to the testing needs of multiple different products. Without flexible test equipment, you are stuck with building new hardware every time you come up with a new product.

AMETEK's ReFlex Power™ modular AC, DC and load system can provide a flexible and unique solution for automatic test equipment. With this system, design engineers can mix and match their own power supplies and loads, using the same testing hardware on hundreds of different products. With today's military Common Family of Testers, the ReFlex power system is the go-to solution for every modern ATE system.

The key takeaway from advanced testing solutions is that the more automatic, adaptable and modular you can make your test equipment, the quicker you can get your products to market.

### **AMETEK Programmable Power: Driving Innovation Through Advanced Equipment and Expertise**

As a global leader in electronic instruments and electromechanical devices, AMETEK Programmable Power specializes in developing highly-differentiated power and testing equipment for the world's leading markets.

AMETEK Programmable Power designs, manufactures and markets precision AC and DC programmable power supplies, electronic loads and application specific power subsystems, as well as advanced testing solutions. With a long and successful track record in the military and aerospace sector, we design the power and testing solutions that push the industry forward.

Not only do AMETEK Programmable Power's power supplies perform better, but they can also reduce your mean time to repair, or MTTR, allowing you to reduce downtime and get your systems back online faster. Since our power supplies are modular, you can take out individual components rather than having to replace the entire system.

However, what AMETEK Programmable Power offers is about much more than just equipment. As your power partner, we have the expertise to help you to develop custom, adaptable equipment that will meet your specific needs, every time.

When you come to us with a set of requirements, our experts will help you to validate those requirements. If we see any inefficiencies or better ways to get the results you are looking for, we will point you to an optimal solution. If something is outside the realm of our current power and testing capabilities, we will let you know, then help you find a path to still get what you want.

With our experience in a wide variety of markets, applications and industries, AMETEK Programmable Power has the unique ability to design the best power and testing solutions for your specific needs, even if it is something that has never been done before. Our decades of experience developing next-level solutions allows us to take what we have learned from other applications and use that wealth of knowledge to your advantage.

At AMETEK Programmable Power, we combine this experience with our valuable custom product offerings for a full-service approach to power and testing. That's a true power partner.