

Reducing uncertainty in aerospace development

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For most of the industry's history, aerospace has treated custom-built as the default answer to demanding applications. The reasoning behind this was sound — the environments are punishing, the certification bar is uncompromising, and the consequences of failure are severe. A motor engineered from scratch for a specific application on a specific aircraft could be optimized down to its electromagnetic core architecture, and this level of precision has always been prized.

That instinct for customization remains deeply embedded in aerospace engineering, but it is increasingly being tested by the realities of modern program development.

Certification requirements have grown more stringent and more time-consuming. Program timelines are shorter, not longer. New entrants, from urban air mobility platforms to unmanned aviation manufacturers, are competing to be first to fly, while cost pressures that were once largely confined to the industrial world are now firmly established across the commercial aerospace landscape.

The strategic response to these pressures is not, as it might first appear, to double down on custom design in the pursuit of certainty. It is often the reverse: to start with a commercial-off-the-shelf (COTS) motor platform whose environmental performance has already been tested against aerospace requirements, and to customize only where the application genuinely requires it.

The value of a known starting point

For aerospace engineers, the value of a known starting point is not convenience—it's predictability. The more performance characteristics that are already understood

and documented, the less uncertainty teams carry into testing, qualification, and certification activities.

Against that backdrop, DO-160G is an important reference point for aerospace development. Published by RTCA as *Environmental Conditions and Test Procedures for Airborne Equipment*, it provides a recognized framework for evaluating how equipment intended for aircraft installation performs under representative environmental and electromagnetic conditions. While not a substitute for system-level qualification, it nonetheless provides a common language and test baseline for assessing whether components are robust enough to be considered in an airborne environment.

For motors, that distinction is especially important. Whether integrated into out-of-cabin actuators, environmental control systems, fluid valves, or door actuation mechanisms, the motor plays a fundamental role in overall system performance and reliability. As a result, documented motor-level testing and characterization offer valuable risk reduction and design validation prior to undertaking more costly and time-consuming system-level qualification activities.

That is where environmental testing against requirements such as DO-160G becomes meaningful. By evaluating how a motor responds to shock, vibration, temperature extremes, humidity, and corrosion, engineers gain a clearer understanding of its behavior under representative aerospace conditions. System-level qualification remains essential, but component-level environmental data gives teams a more predictable foundation before integration risks begin to compound.

An OEM integrating a motor that has already been tested against DO-160G requirements is not starting from an unknown. It is starting from a robust, quantified base — a component whose environmental behavior is already characterized and documented. That has two practical consequences. The OEM's own in-house testing, which typically precedes formal certification submission, proceeds faster because the motor is not the source of uncertainty. And when qualification does

encounter problems, the debugging work is confined to the system integration, not to the motor design itself.

The alternative is a scenario every program manager knows too well. A clean-sheet motor fails an environmental test late in the qualification cycle, and the design must go back to the drawing board. The redesign itself can represent a significant cost, but it is only part of the larger impact: months lost, the certification window pushed back, and knock-on effects on every downstream system that depends on the motor being available.

Starting from a COTS platform does not eliminate that risk entirely, but what it does is de-risk it substantially.

Where customization earns its keep

If starting with a proven motor platform is the strategic move, the next question is a practical one. Aerospace applications are not generic; each has its own geometry, its own drive characteristics, and its own interface requirements. How much customization is possible before the COTS foundation is compromised?

The answer, in practice, is more than most engineers assume.

A well-designed aerospace motor platform is engineered from the outset to accommodate targeted customization. The shaft can be adapted to transfer torque effectively to the application, including specific output geometries or even gear-cut features where required. The mechanical interface, including mounting features and housing design, can be tailored to fit the host assembly. The cabling and termination can be configured for the specific electrical interface the system requires. And the winding can be adapted to match the required speed and torque under defined power inputs, such as voltage and current, so the motor aligns with the application's characteristics without altering the underlying platform.

The result is a design approach that leverages an established motor architecture while focusing engineering effort where it directly serves the application.

Two approaches, one strategic question

It's important to remember that white sheet design and COTS are not competing philosophies. Instead, they are complementary tools, and the engineering judgment lies in knowing when to reach for which.

For the most demanding applications — primary flight controls on next-generation commercial aircraft, for example — a fully bespoke motor design generally remains the right approach. These are applications where every parameter is driven to its limit, where the system is designed around the motor as much as the motor is designed for the system, and where the additional development time and cost are justified by what the application demands.

For a growing share of other aerospace applications, however, the situation is different. A COTS platform with targeted customization offers a faster path to a testable device, a lower program risk profile, a more predictable supply chain, and a development foundation backed by documented environmental performance data. The OEM adapts the surrounding system to the motor rather than the other way around. In many applications, that constraint is a manageable one, far outweighed by the program-level benefits of starting from a known platform.

The strategic question, then, is not whether COTS or custom is better in the abstract, but where engineering effort creates the most value: in the motor itself, or in the system built around it.

A shift the industry is already making

The move toward this way of thinking is not being led by any single manufacturer, but by the shape of the industry itself. New entrants in advanced air mobility cannot afford multi-year, clean-sheet development cycles.

Established commercial aerospace OEMs are looking harder at where they need custom and where they can benefit from standardization. And the same modular logic is spreading beyond motors to the actuators themselves, with some OEMs now developing standardized actuator platforms with flexible interfaces — a layer of reuse one step further up the stack.

For the design engineer, the strategic question has shifted with it. The old question was *“how do we design a motor that will meet this application?”* The new question, increasingly, is *“where does customization actually earn its keep on top of a known base?”*

Portescap's Aero platform—a range of aerospace precision motors and accessories supported by DO-160G environmental test data at the component level—has been developed with this shift explicitly in mind. But the principle is broader than any single product line. In a discipline where the cost of a certification failure is measured in months and millions, the strategic instinct to build on known performance, and to spend engineering effort only where it genuinely differentiates, is one that will matter regardless of which platform an OEM chooses to build from.

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Image captions:



Image 1: For many aerospace applications, a COTS platform with targeted customization offers a faster path to a testable device.

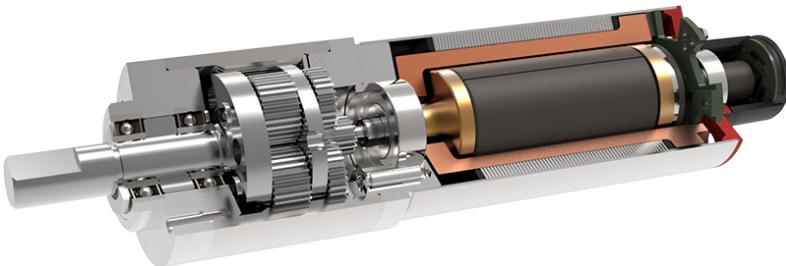


Image 2: Portescap's Aero platform is a range of aerospace precision motors and accessories supported by DO-160G environmental test data at the component level.

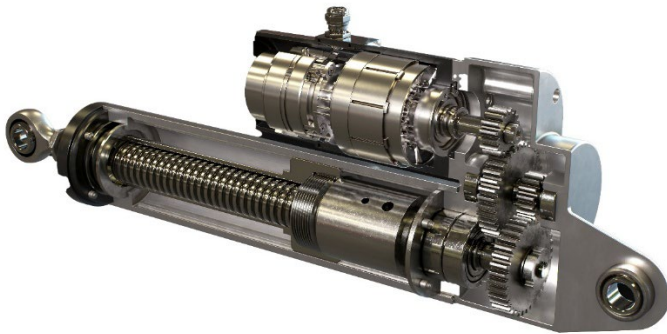


Image 3: Electromechanical actuators depend on reliable motor performance, making documented component-level testing an important foundation for reducing risk before system-level qualification.

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Portescap, a proud member of Regal Rexnord, excels in addressing critical motion challenges with premium miniature electronic motors and components. For over 70 years, our extensive product range – including coreless brush DC, brushless DC, stepper, gearhead, encoder, and controller technologies – has powered applications across the aerospace and defense, automation, industrial power tools, medical, robotics, and surgical hand tool industries. Expert engineers collaborate with you from prototype to production, ensuring exceptional performance tailored to your specific needs.

As part of Regal Rexnord, customers benefit from seamless access to a vast brand portfolio and a robust global manufacturing and sourcing network. Dedication to innovation and sustainability drives us to design products that significantly impact daily life. Leveraging Regal Rexnord's broader expertise and resources, we aim to deliver sustainable solutions that power, transmit, and control motion, helping to create a better tomorrow.

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