Starting early: the advantage of involving miniature motion design at the outset of OEM projects

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Miniature electric motors, their transmissions, feedback and control devices are crucial to equipment that depends on motion control. This means that OEMs starting a new product development project should involve a motion specialist at the earliest opportunity. The motor and its output have a broad impact on the overall design, so early-stage inclusion will not only optimise the performance of the host equipment, it will also streamline project development.

Dave Beckstoffer, Business Development Manager at Portescap, explains.

By controlling the torque, speed, acceleration and position of its shaft, the electric motor is the fundamental tool that brings life to devices used in everyday settings, as well as equipment deployed in many surgical and industrial environments. For many of these applications, higher power over 1kW or more isn't necessary, and the size of the host equipment might need a small and lightweight motion system.

Precision control

Even when a compact motion system is required, typically generating below 1 kW in power and measuring around 90 mm or less in diameter, the demands placed on it can be high. Motors, transmissions, and controls that power the joints of a surgical robot, for example, need to provide pinpoint precision, as do those that guide satellite communications devices. If the motors are controlling medical equipment, such as patient infusion systems, they must also ensure absolute reliability, also a typical requirement for military applications.

Whatever equipment the motion system is driving, its performance capability and design attributes need careful consideration. These aspects will impact the ability of the host equipment to fulfil its task to the required level of speed or accuracy, and it can also affect the size and weight envelope to ensure optimal design integration. As motion solution development also has implications for the overall OEM project in terms of time to market and cost, this makes it highly beneficial for the OEM engineering team to include motion design at the earliest opportunity in the general project timescale.

Including motion design from ideation

When the OEM engineering team turns their attention to concept development, and preferably when they're still working on the ideation phase, motion system considerations should be included. Even if general assumptions on motion solution design can be worked with at this stage, involving motion design engineers to advise on the specification from this point will ensure that later design choices aren't constrained.

Every OEM project has objectives for the overall equipment design that are, more or less, set in stone, and they often relate to precision, speed and reliability – attributes that significantly depend on motion solution design. Early involvement of the motion engineering team will ultimately help to ensure that these final objectives can be met in the most effective way.

Of course, if the OEM goes it alone, their early motion solution decisions will be based on standard products and constrain the equipment's overall design. They can change the motion solution specification at a later stage, but this additional rework will result in a longer time to market and extra cost.

Confirming specification at concept approval

At the concept stage, OEM engineers will formalise their overall design. At this phase, an off-the-shelf motion solution is usually involved for proof-of-concept

purposes. Typically, an OEM engineering team working alone will use an oversized motion solution to give a safety margin in terms of the torque or speed required. While this approach will, roughly, help to zone-in on the operational performance they need, it will also mean that the final choice of motion solution has to be scaled down later on to meet the optimal envelope for mass and dimensions, as well as energy efficiency.

One way to identify more accurate performance requirements early on is to measure the current in the device across its range of load and speed working points, including all potential cycles as well as any peak duty needs. With assistance from a motion engineering team, this approach can more accurately determine the necessary size of the motor, as well as the required gear reduction to achieve the optimal speed-torque and inertia balance. This stage should also include the specification of the feedback device, including its position in the design, as well as the motor's drive controller.

Significantly, confirmation of these aspects at the concept phase will also inform whether an off-the-shelf design can fulfil the objectives, or whether customisation to any attribute is necessary, through to the potential of a completely tailored system. The outcome of this decision can have a high impact on the time and cost of the overall project.

Confirming design ahead of feasibility

The feasibility stage is the longest period for the overall design of any development project. However, for the motion system, its form factor and performance requirements shouldn't change in any significant way – providing that the appropriate considerations have already been made during earlier design phases. Instead, motion engineers should use the feasibility stage to fine-tune the motion solution for optimised performance and efficiency.

If the motion solution design hasn't been confirmed at a prior stage, decisions taken now involving the size or even type of motor, transmission, feedback and control

devices, could demand a rework of the host equipment's design, as well as integration options. This will inevitably add unnecessary time and cost to project development.

By involving a specialist motion solution design team at the earliest stage in OEM development, the process will be streamlined, enabling a faster time to market and lower engineering costs. Most importantly, engaging with a motion designer at the outset is the most effective approach to optimise the ultimate performance of the equipment and best meet the original design objectives.

Image captions:

Image 1: Involving motion design engineers to advise on the specification will ensure that later design choices aren't constrained.

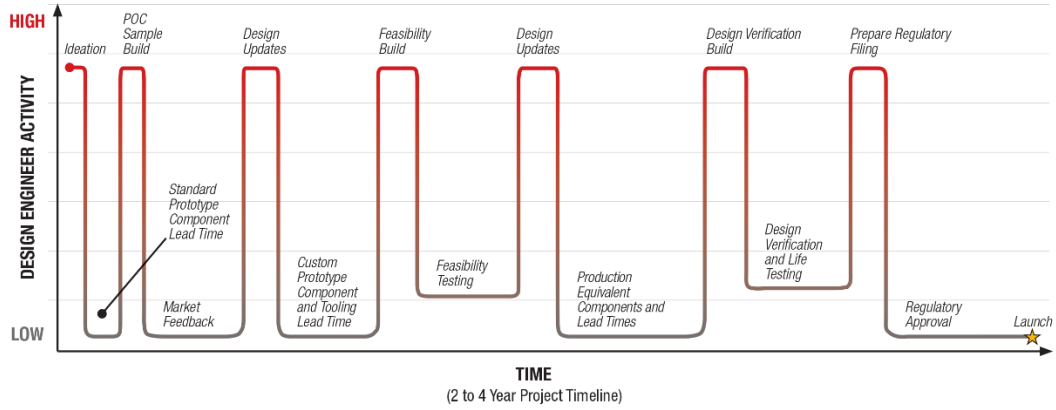

Image 2: By involving a specialist team at the earliest stage in OEM development, the process will be streamlined, enabling a faster time to market and lower engineering costs.

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Portescap offers the broadest miniature and specialty motor products in the industry, encompassing coreless brush DC, brushless DC, stepper can stack, gearheads, digital linear actuators, and disc magnet technologies. Portescap products have been serving diverse motion control needs in wide spectrum of medical and industrial applications, lifescience, instrumentation, automation, aerospace and commercial applications, for more than 70 years.

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