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6 Steps to Getting Your Instrument Development Process Moving

By Brian Handerhan

ENGINEERING YOUR SUCCESS.

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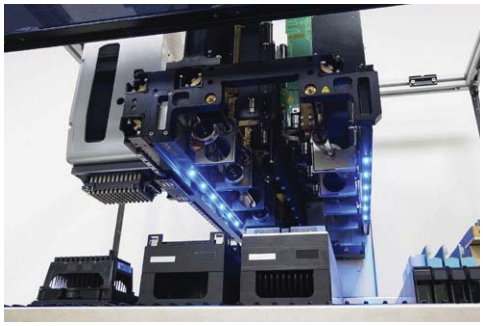
It seems that we cannot turn on the news without hearing the word "Pandemic." As our world continues to get smaller due to population growth and globalization, these threats increase and hit closer to home. This is resulting in increased workloads at both diagnostic laboratories that are testing potential patients and pharmaceutical laboratories where the next generation of treatments are being developed.



As a result, there is an accelerating demand for laboratory instrument OEMs to introduce new products to the market. With the increased demand and variety of tests, many instrumentation OEMs are finding they are better off focusing their resources on the science and chemistry of testing rather than on the mechanics of designing instruments. Increasingly, instrument OEMs are supplementing their internal engineering staffs by partnering with solution providers that can take on subsystem design responsibility and deliver a modular, bolt-in solution. These OEMs are driving more revenue through consumables and want to staff their technical teams accordingly. By picking the right automation partner, outsourcing can be an effective way to reduce the risks and accelerate their development cycle.

New instrument research and development is rapidly changing and the focus is on smarter, smaller and faster. Motion systems are one of the key elements in laboratory instrumentation design. Many of the companies developing these instruments are deciding to rely on design partners like Parker as an extension of their development team. This way they can focus their resources on developing their next assay, which is truly where they are generating their revenue and where more of their resources need to be focused in reacting to the changing environment.

Inside of a laboratory instrument, the motion system represents a key system that influences the commercial success of any instrument. From a technical perspective, the design of the motion system plays a major role in:

- Minimizing footprint or space consumption
- Increasing throughput
- Reducing cost
- Minimizing instrument costs
- Reducing consumable or sample size
- Improving robustness
- Extending maintainability
- Exploiting flexibility to create additional customer value

But no matter how capable the motion system partner is in meeting those expectations, they're not of much value if they can't also help you be the first to market. Competitors have similar instrumentation, so being the first with a new capability to hit the laboratory floor is a huge advantage. The following approach, has been developed from years of experience in partnering with OEM machine and instrument builders across multiple industries. One of the longest and highest risk phases of any development project is the initial prototype or feasibility phase. During this phase, both the process development and throughput optimization efforts need to be started. If your current instrument does not have the capability to start your process development efforts, the new prototype instrument becomes even more important to the overall success of the program. So getting that instrument as specified and as quickly as possible, by reducing the need for extensive iterations, can greatly accelerate the overall development.

6 Critical Steps for Accelerating Motion System Development

Now that we've established some of the life sciences OEM's key challenges, let's look at the six critical keys that accelerate your development process when working with a system supplier:

1. Understanding the OEM's Needs

The first step in any project with a subsystem supplier is to understand the needs of the instrument's process. In the case of the motion system, this constitutes translating the OEM's process requirements into the language of motion. Attributes like throughput times are converted to distances, acceleration, velocity and settling time. Other attributes like target size are transformed to accuracy, repeatability, flatness and straightness. At this point, a common understanding will be developed across the two teams as to the priority of the requirements.

If there are concerns about the validity of the process requirements that can only be proven through process development, a rapid proof of concept will be recommended. Because of Parker's extensive portfolio of industry proven motion products, this can be assembled quickly so that process development can begin in parallel to the overall instrument development. Although the proof of concept would not necessarily meet the space requirements, it will provide a platform to ensure the needs are clearly understood as early as possible so the ultimate solution can be optimized.

The motion specification developed in this initial phase serves as the foundation of the design, then gets converted in the Acceptance Test Procedure, and ultimately transforms under the production subsystem pass/fail testing criteria. Because of the foundational importance of this shared specification, it is crucial that it be developed through collaborative engineer-to-engineer dialogue.

2. System Analysis

If the shared specification serves as the foundation of a successful development, the System Analysis step serves as the keystone. This step is about performing analytical engineering to model the highest risk elements of the machine or process requirements to ensure that an optimum solution is designed. The biggest delay in any development activity comes with iterations. The idea is to "fail early" and fail on paper before the system is built.

Parker has created a suite of analysis tools that we use to predict the output and performance of various motion technologies and components in countless configurations. We continually upgrade and refine these tools through our OEM development process by testing the output of the predictive analysis with real world results.

The system analysis step produces a “confirmed” conceptual design and lays all of the groundwork for a design engineer to start creating the final design.

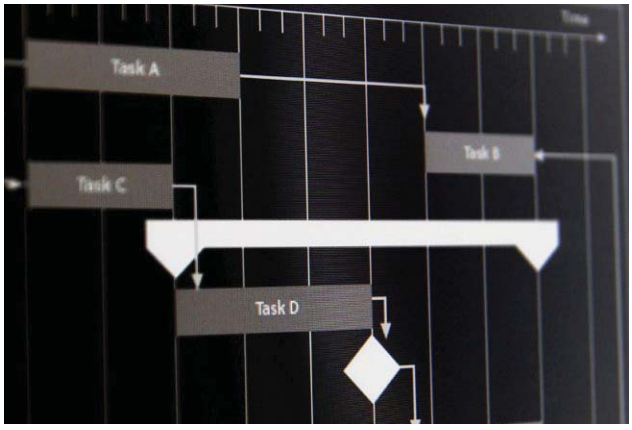
3. Solution Proposal.

The solution proposal step serves as the first gate in this overall process. The value and focus of this step varies depending on the OEM’s needs. In the case of an OEM with a very flat organizational structure, the decision makers will likely have been involved in the details up to this point. In the case of a large OEM, the design team may need to sell their choices and selections to higher-level decision makers. The solution proposal becomes the ultimate “selling tool” for those design teams.

The solutions proposal is the completed documentation of the specification development and the system analysis. It provides clear traceability to all of the design decisions to date. Once Parker provides this proposal to the OEM design team, it becomes a key part of their documentation trail. As the project moves forward, new revisions of this document are managed, including all design choices. All of the supporting calculations are also documented, defined and evident for future reference.

4. Project Management

For project management, a regular cadence of meetings is recommended, but the duration and frequency will differ depending on the project timeline—although weekly is optimum. These meetings should review the timeline and key action items to keep everyone on track. Both the supplier team and the OEM team should have a central point of contact (project or program manager) who owns the timeline. Another best practice is to have a shared, secure network drive where all applicable project documents can be shared and viewed, both live and concurrently.



Parker uses two major milestones through the design cycle: a Preliminary Design Review and a Critical Design Review. In preliminary design engineers get into the details of the form, fit and function. After that first sign-off, long lead items that are not as affected by the design can be ordered so they won’t affect the delivery of the first prototype.

By the time of critical design review the design should be 100% complete and ready to be released for manufacturing for the final sign-off. Done right, this process will get that first prototype design done as quickly as possible without major problems.

5. Acceptance Test Procedure

The Acceptance Test Procedure (ATP) is a realization of the original specification. Where the original specification can be seen as a list of desired performances, the ATP is a documentation of the actual expected performance in terms of GO/ NO-GO performance, including how the measurements are going to be performed. Often the engineering team from the customer will want to be present for the ATP at the manufacturing site, or the ATP will be duplicated upon receipt at the OEM. Either way, this process ensures that the system is delivered as agreed upon.

6. After-Sales Support

Because OEMs want to build global distribution networks to serve growing and emerging markets, it is also important for them to build strong service support networks. If that equipment prototype is going to be used halfway around the world, it is important to be able to get the design engineer they've been working with since the beginning of the project on an airplane when needed. The problem is, that could take weeks. A good alternative for an OEM is to work with suppliers that have local support in the same markets in which they do business. Where the life sciences equipment market is concerned, the supply chain becomes a lifeline for the clinical, diagnostic, and research laboratories that give this market life.

Summary

Instrument development is accelerating and changing due to both increases in demand and new industry requirements. Whether you are doing your own design and build or working with partners to expand your team, the feasibility and development phases can drive your development costs up and push your timelines out if not properly managed. Our focus is on an early proof of concept where parallel process development is required—as is optimizing the design through early soft iterations. The key is to fail early and fail on paper, eliminating expensive and time consuming hardware iterations.

About the Author:

Brian Handerhan is a business development manager focusing on Parker's Life Science Automation group. Brian has more than 20 years of experience in the implementation of automation across a broad range of industries. His primary expertise has been as a process improvement leader, change agent, and P&L owner. He now focuses that broad experience on working with industry OEMs to develop lasting business relationships built on both operational and technical value.

Parker Hannifin

Parker's name can be found on and around everything that moves. We manufacture highly engineered components and systems. The Electromechanical Division delivers a wide range of high-quality motion control systems to meet any application need. Solutions are designed for easy configuration to make a complete motion system - from miniature precision for life sciences to overhead gantries for the factory floor. In the life sciences, motion systems range from analytical instruments through liquid handling robotics. Parker's process for system solutions has helped many world leading life science companies develop next generation instruments. Parker's focus on solving some of the world's greatest engineering challenges sparks our passion for innovation and secures our future growth. Our technological expertise creates a more sustainable future for us all.

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