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Quality Computing

Use an enterprise view to

Select SPC software

Statistical-process-control software has become such a valuable manufacturing tool that the choice of a program affects more than just quality professionals.

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When statistical-process-control (SPC) techniques first entered the limelight two decades ago, they were typically used by quality engineers as an esoteric backroom analytical effort, resulting in the posting of paper-based control charts. These were used as guides for production floor operators to keep their processes within specified limits. While many of these early SPC efforts made great strides in helping characterize production processes and bring them under better control, the cumbersome nature of the analysis and the lack of timely feedback mechanisms made it difficult to dynamically integrate SPC.

Statistical-process-control software helps control quality on Lockheed-Martin's F-16 production line at the Ft. Worth, TX, plant.
Photo: Lockheed Martin Tactical Aircraft Systems

Over the past few years, the rise of a new generation of SPC software tools has opened the door for full integration of real-time SPC on the production floor with flexible, on-line analysis and data reporting throughout the organization. However, along with the expanded options for software-based automation of SPC programs comes the dilemma of choosing the optimum software fit for your specific requirements.

Available software choices range from relatively inexpensive standalone packages to highly integrated control and analysis packages, with network capabilities and sophisticated interfacing to back-end databases. When selecting SPC software, decision-makers must first clearly understand their own production requirements and match them with the most appropriate level of investment for today. At the same time, it's important to look ahead and ensure that the chosen package will be able to grow with tomorrow's inevitably changing production environments.

Pre-implementation planning

Frankly, many manufacturers decide they need an SPC program only as a response to mandates by their customers or as a prerequisite for ISO/QS 9000 certification. Since this perspective usually paints SPC software as a "cost" of doing business rather than a proactive "investment" in production, it is tempting for small- to mid-sized companies to implement "just enough SPC" to obtain the required check-off on the qualification form.

However, with today's software-driven systems, the intrinsic productivity and quality benefits of a well-planned SPC implementation can quickly manifest themselves. A rigorous planning, self-assessment, and selection process most often will result in a tailored implementation that achieves the desired objectives.

One of the first keys to success is the establishment of an inter-disciplinary steering committee to evaluate and select SPC software. With the need for data-sharing inter-relations between all of today's manufacturing systems, the selection of SPC software can no longer be the province of only the quality-assurance department. Even the most basic standalone control packages need to provide data and reports in standardized formats that can be uploaded, if necessary, for more in-depth analysis.

The selection committee should typically include, at least, the QA manager, a production operator, and representatives from the information-systems department, manufacturing engineering, production management, and finance. For multi-plant SPC implementations, it is also important that committee members be drawn from across all the participating facilities. Broad-based participation in the selection process can also help build the necessary levels of commitment that will be vital to successful implementation.

In formulating the requirements specification, the selection committee should take into account the often divergent needs of hands-on production floor operators as well as quality analysts and managers. All too often, the selection of SPC software is driven solely by the QA analyst's requirements and fails to address ease-of-use issues—which can make or break the production-floor implementation.

Early in the self-assessment process, it is important to determine what role the operators will play in the ongoing SPC implementation. Are they already using paper-based SPC control charts? Are they computer literate? How much experience and latitude is currently required to deal with out-of-control conditions? Answers to these questions will help the selection committee tailor the SPC user-interface requirements to fit existing operations.

The SPC software must enable analysts to "see the big picture" and to communicate their findings to others within the organization. The ability to customize the software's statistical sets, charts, and reporting formats can allow quality analysts and other power-users to tailor the system to the organization's specific requirements rather than having to select only from a list of vendor-defined summaries and reports. For today's complex multi-process, multi-part production environments it is also important that SPC analysis software allow the QA analyst to easily sort and view the data in a variety of different ways, such as by production dates, times, process operations, characteristics, and lot traceability.

To allow smooth integration and effective use of SPC data throughout the organization, enterprise-class SPC packages need to support existing data-exchange standards and open systems concepts. For instance, selecting a package that does not run in a Windows environment and fully support the Microsoft Dynamic Data Exchange (DDE) standard is a recipe for creating an isolated island of data.

Even for a standalone single-purpose SPC system dedicated to one production

machine, the lack of standards compatibility is a major roadblock to uploading the data for broader analytical purposes. For networked SPC systems that are intended to function as part of a larger database, the support of additional standards, such as ODBC (Open Data Base Connectivity) and SQL (Structured Query Language), become key requirements for sharing real-time data throughout the organization.

The software should also allow analysts to quickly create data-collection and analysis setups for new parts or to modify existing part setups as production requirements change. Support for the Object Linking and Embedding (OLE) standard plays a key role in making this possible by treating all customized routines as "software objects" within the overall SPC program structures. Essentially OLE allows specific software routines, such as part setups, report formats, export functions, and database connections, to stand alone as separate entities, distinct from the core code of the SPC system. Therefore, new OLE routines (such as new part setups) can be created and/or modified without requiring any modification to the underlying system programs.

Not only does this make it possible to quickly set up SPC controls for new parts and processes, it also enables separate departments and functions to customize statistics and reports for their own needs, without inconveniencing other user groups.

SPC implementation alternatives

Over the past decade, the proliferation of SPC alternatives has created a wide range of choices for today's manufacturing decision-maker. Some of the alternatives and their specific applicabilites include:

- Built-in SPC offerings from equipment manufacturers. The industry-wide push for SPC data collection and analysis has led most manufacturers of production and metrology equipment to offer built-in SPC packages, as well as methods for connecting their equipment to third-party data collectors and SPC software. While these built-in SPC packages may offer a reasonably useful set of control-charting capabilities, such as min/max control limits, X-bar, and range charts, they are typically most appropriate for batch-by-batch processing. For anything more in-depth, or for ongoing analysis across multiple runs, it is generally wiser to implement a more flexible SPC package from the outset.
- General-purpose spreadsheets. The obvious advantage to doing SPC analysis with a spreadsheet is that you probably already own one for other purposes, thereby saving the cost of separate SPC software. However, the downside is that you have to be the SPC expert rather than relying upon the software. Because the entire task of creating the data tables, analysis structure, and control charts falls to the analyst, the use of a raw spreadsheet program really amounts to little more than a computer-assisted version of hand-calculated SPC.
- SPC-specific spreadsheet add-ons. Some inexpensive SPC software packages, such as SPC KISS from Air Academy Associates (Colorado Springs, CO), are built directly on top of leading spreadsheets such as Microsoft's Excel, by adding specialized SPC functions and pull-down menus. Intended primarily for standalone control and analysis, these SPC applications have the advantages of quick and flexible deployment combined with simple

straightforward user interfaces. For instance, Lockheed-Martin's Tactical Aircraft Systems facility (Fort Worth, TX) widely deploys SPC KISS as an ad hoc method for analyzing production floor data and conducting process improvements (see "Implementing flexible ad hoc analysis," below).

- Standalone and integrated SPC systems. The majority of today's SPC software packages fall into this category, providing a range of dedicated SPC capabilities, which can be deployed in either standalone or networked configurations. (For a listing of suppliers of standalone SPC software, use Quality Online's Software Buyers Guide.)

All of these companies offer SPC control packages that run in standard Windows environments and support data exchange through DDE. However, some vendors split out the analysis, database interface, and/or network connectivity capabilities as separate modules from the basic feature set. Therefore, it is important to determine which of your needs are covered by the basic version and which ones will require add-on optional modules. From a database standpoint it is also important to ascertain whether the vendor supports "full ODBC compliance" that will ensure connectivity to both high-end corporate databases, such as Oracle (Oracle Corp., Redwood City, CA), Sybase (Sybase Inc., Emeryville, CA), or Informix (Relational Database Systems, Menlo Park, CA), as well as low-cost databases such as dBASE (Borland International Inc., Scotts Valley, CA), Paradox (Borland), or FoxPro (Microsoft, Redmond, WA).

Data collection and gage management is another key area where you should be aware of differences among SPC software packages. Some standalone versions are intended primarily for keying in the data entry while others support extensive options for a variety of automated gage interfaces. Some vendors also offer full lines of hardware data collectors that interface to their SPC packages. Accurate management of gage R&R (reproducibility and repeatability) is a critical part of the success of any SPC program, so it is essential that you determine the extent of integration that you require before selecting your SPC software. While it is certainly possible to conduct gage R&R separate from the SPC program, there are definite advantages to an integrated database that allows flexible cross-analysis between gage-control and product-control charting.

Finally, remember that every SPC implementation needs to leave room for growth and change. Don't assume, just because you don't need network connectivity or a shared relational-database interface today, that you'll never need them. While it is clearly cost-effective to invest in only what you need right now, it can be even more costly to get locked into a standalone system that won't grow along with your future needs. Also, keep in mind the future requirements of your customers and whether or not you will want to someday share SPC data directly with them through data-exchange standards or even the Internet. Before making your final vendor selection, consider carefully whether they are capable of growing with your changing requirements.

The bottom line

SPC software is a tool that can only be effective when properly used. Whether the impetus for SPC is externally driven by customer requirements or is internally generated, it is vital that manufacturers first understand their own processes and

determine the objectives of the SPC implementation.

It's also highly recommended that you run real-world samples of your specific data through the two or three SPC-software "finalists" before making your selection for full implementation. Not only will you get a hands-on feel for how easy it is to set up your own parts within the system, you'll also discover how well it performs in your real computing environment. In addition, you should ensure that it can adequately address any industry or company-specific requirements, such as the prevalence of short-run production in the aircraft industry.

By thoroughly understanding your real-world requirements and tailoring your selection to meet both production floor and organizational needs, you can ensure that your SPC software truly serves the strategic objectives of your corporation instead of just representing an expensive and time-consuming investment to obtain a checkmark on your customers' vendor-qualification forms.■

Application Notes

Implementing flexible ad-hoc analysis

Lockheed Martin Tactical Aircraft Systems, Fort Worth, TX, is responsible for manufacture and final assembly of the F-16 fighter aircraft. To support these manufacturing efforts, Lockheed Martin is implementing a Six-Sigma SPC program, which has involved extensive "black-belt" training in design-of-experiment techniques and statistical problem solving. In conjunction with the black-belt training, Lockheed Martin's staff has also adopted SPC KISS software as an easy-to-use ad hoc tool for production floor data analysis.

According to Todd Kibler, Lockheed Martin's senior specialist for statistical-process control, "The combination of low-cost and ease-of-use has really given our SPC-trained black-belts a tool that they can immediately put to use on the production floor. We use it to quickly analyze data, calculate control charts, and assess short term process capabilities. Then, as required, we can drill down for deeper levels of analysis within the same basic program, such as the need to compare data from multiple populations or analyze non-normal distributions. Also, because we already used Excel for many different applications throughout the plant, SPC KISS was a natural fit that didn't require our staff to completely learn a new user interface before putting it to use."

While not used as a universal SPC solution, the flexibility and easy portability of SPC KISS acts as a natural augmentation to Lockheed Martin's existing installed base of data-collectors and dedicated process-monitoring devices. According to Kibler, "We use ultra-high-end statistical analysis software packages for overall process characterization, but for analysis where we need to crunch a mass of specific data to solve a particular problem or improve a particular process, it's great to have an inexpensive, easy to use tool that covers all the fundamental basics of SPC."□

Application Notes

Material savings through SPC monitoring and analysis

Delphi Interior and Lighting (Anderson, IN) is a major supplier of interior and exterior lighting fixtures to the automotive industry, specializing in a wide range of injection-molded plastic components. Delphi initially was looking for a portable data-collection system that would allow them to measure parts on the production floor and get instant feedback for controlling and improving processes. Because it was important to tightly integrate dedicated data-collectors with the SPC software, Delphi selected the combination of GageTalkers and VisualSPC, both from GageTalker CimWorks, Bellevue, WA.

According to Vern Manwaring, manager of Delphi's Statistical Resource Center, "One good example of the benefits of the VisualSPC software implementation has been in our short-run SPC control over injection molding. Essentially, we've made a key transition from checking specific products to monitoring the machine's process. Although we run many different parts through the machines, we are now able to successfully control all the parts with a single chart for each machine."

By monitoring the part-weight variations from nominal or target values for each part, using short-run SPC analysis techniques, Delphi staff are able to accurately monitor the overall shot-weight variations for each of five injection machines. Each time a new mold is set up, the VisualSPC nominal value is tuned to that part's specific target weight, thereby speeding mold changeover operations, reducing total paperwork, and ensuring uniform SPC data collection across all parts run on the machines. Thus far, the analysis has already allowed Delphi to achieve significant materials savings by reducing the required shot weight for the pilot molds, while still producing high quality results. When projected across the more than 4 million injection parts produced per month at the Delphi facility, this materials savings is likely to quickly recover the entire cost of the SPC implementation.□

Application Notes

Automated data collection for real-time corrective actions

Slide-Master Inc., Newmarket, Ontario, Canada, is a metal stamping and assembly plant that manufactures seat adjusters and recliners for the automotive industry. While they had automated test equipment performing 100% inspection on the assembly line, the data needed for SPC were not being adequately captured. Slide-Master's corrective action teams were typically working with limited off-line data. There were instances when timely data would have been very useful to resolve perceived problems with the company's components at their customers' sites. Typical workloads and schedules prevented the data from getting logged and entered into a computerized database until days after it had been collected.

According to Mark Fleming, Slide-Master QA manager, "What we really needed was an automatic collection link that would allow us to flexibly customize which channels to read and how frequently to collect the data from them."

To implement this selective SPC link, Slide-Master chose QA/S GainSeeker SPC from Hertzler Systems Inc., Goshen, IN, in early 1996. The software package was set up to automatically collect the specified test data directly from the Allen-Bradley PLCs and to store the data in GainSeeker SPC for immediate use by quality

engineers. As a result, corrective-action information is now available in a more timely fashion, when it can actually do some good on the production floor.

Overall, the response time to problems has been reduced from as much as 3 days to less than 30 min. In addition, Slide-Master engineers are now able to generate exhaustive customized reports by specific production lots/batches, to assist in resolving post-shipment assembly issues arising at customer sites.□

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