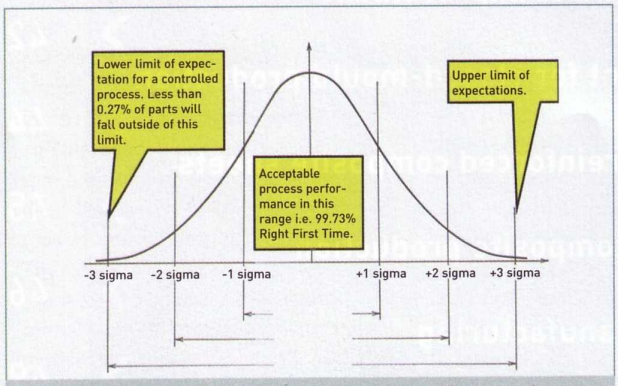
Process capability, the key to high-volume production

In response to the JEC Composites Magazine question of the month, "In your opinion, which processing technology has the brightest future?" found on page 10 of Issue 14, David Skertchly, founder and managing consultant of Product Technik, sent in his comments. We thank him for his enlightened remarks on the subject and are pleased to share his reply with you.

DAVID SKERTCHLY,
FOUNDER AND MANAGING CONSULTANT,
PRODUCT TECHNIK

The question has been asked by JEC Composites: "Which technology has the brightest future"?

Response: all of the present composites technologies have a very bright future, but the composites industry itself faces a very bleak future unless we offer achievable production performance to our customers. Of all the possible process variables, the most important is repeatability. As advanced composites production increases in scale and volume, we need to evaluate the repeatability of processes in a real production environment.



A controlled process will always vary in accordance with a normal distribution, the key is to ensure that 99.73% of the parts meet the process expectations right first time.

The author at the controls of the McLaren F1. This was the first automotive project to use advanced composites throughout. The industrial engineering philosophy made extensive use of statistics and measures of process capability.

To industrial engineers, time is money and they measure repeatability by one single number called process capability, designated Cpk. A capable process (Cpk>1) has greater than 99.7% of its parts inside the specification limits, also called a 3-sigma capability. Hands up those who can produce high-performance composites with a failure rate of less than 3 parts per thousand. The bad news is that a process capability of 1 as a standard is more than 20 years out of date. Most automotive factories expect factories to be working towards a so-called "6-sigma quality performance" with failure rates of less than 3.4 parts per million.

In 1993, we made the world's first attempt to industrial engineer a production vehicle made from advanced composites. We were

aware that without a high level of repeatability, we would fail to meet our very tight production objectives. We defined failure as "Not Right First Time", so the need for even a small amount of rework to a part was counted as a failure. I recall that we started during prototyping with a failure rate of about 30% (+/- 1 sigma) and, by using extensive training regimes and constant improvement techniques, we reduced the failures to less than 5% (+/- 2 sigma) after just 100 vehicles, a very credible performance for those days.

The production of Class A body panels such as these for the McLaren F1 remains the ultimate goal of the advanced composites industry. Statistics and the measurement of process capability will play a key role in this development.

Since then, my interest in the production of body panels for automotive use has led me to review all the various processes on offer. Their suppliers and inventors all claim to be able to make panels of very high quality, and this is undoubtedly true, but what few vendors can claim is a figure for repeatability measured as Cpk or parts per million defectives. It is this number which will be the key to the adoption of composites; until the composites industry can claim a repeatability of less than 3 parts per thousand defectives, we can expect the major automotive OEMs to be wary of composite processes.

It is understandable that those in universities or industry who develop a new process will be keen to sell its benefits to potential customers, and their enthusiasm may lead them to overestimate its performance in production conditions. This over-optimism risks eroding confidence in the composites industry as a whole. As an industry, we must become objective in our view of process performance.

The author with the McLaren production team leaders and quality engineers who used statistics to measure and improve their team's performance.

Background to the author

David Skertchly became involved in composites production in 1983, becoming Composites Technology Group manager for Matra Marconi Space. From there, he joined McLaren to become the founding director of McLaren Composites, producers of the McLaren F1 supercar and the McLaren Mercedes SLR. He is now founder and managing consultant of Product Technik, a consultancy with clients in the UK and India dedicated to the industrial engineering of advanced composites.

I would like to call on all those developing new or improved composite processes to measure and declare the repeatability or universal process capability of their process at the claimed rate of production and in realistic configurations. Likewise, I would call upon those selecting a process to review and validate the claims for repeatability as they would other parameters. This will stimulate full development of processes before they reach the market and assure a bright future for the composites industry as well as for the particular processes. ■

More information: www.product-technik.co.uk