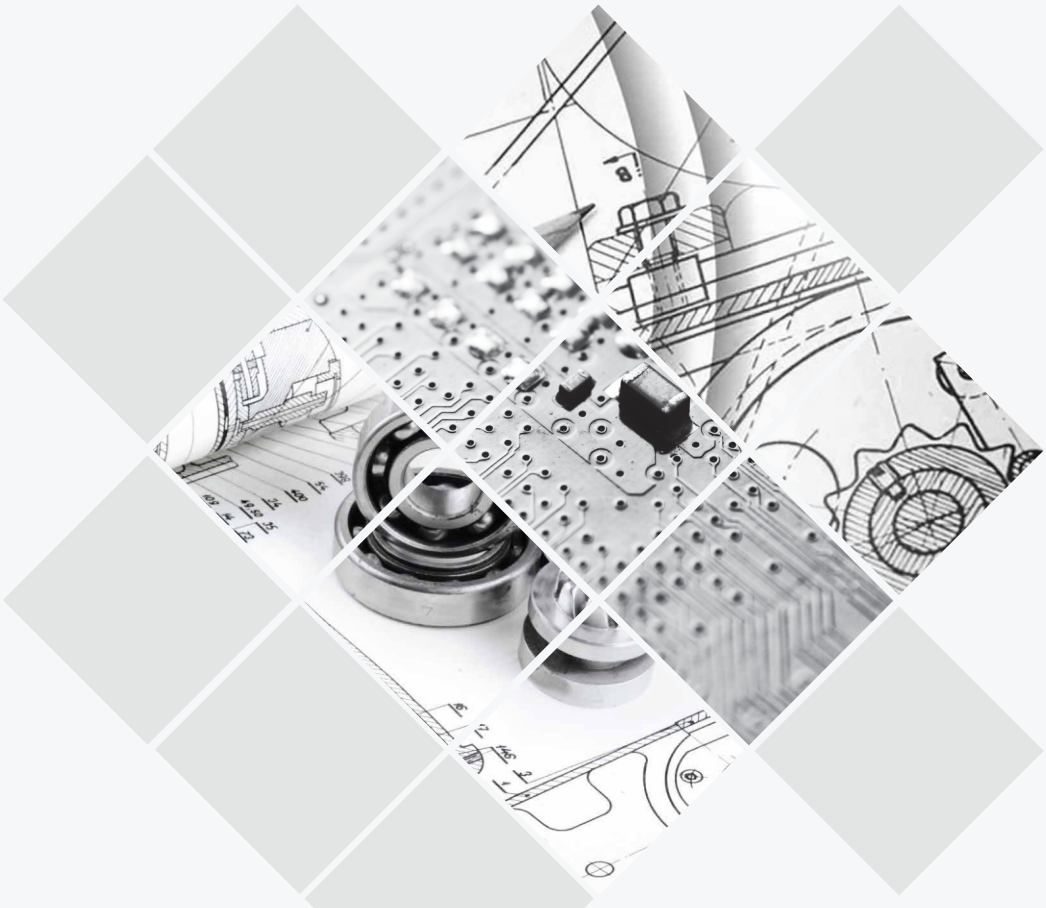
QUEST

BORN TO ENGINEER

Need of the Hour: A Customized Solution to Shorten the Manufacturing and Development Lead Times

Evaluation of Manufacturing Industry for easy data transition, verification external to the machine, error free programs, avoidance of re-work and tool breakages



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QuEST Global

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Need of the Hour: A Customized Solution to Shorten the Manufacturing and Development Lead Times

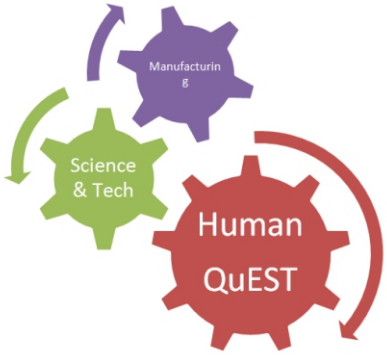
1. ABSTRACT

Manufacturing industry is going beyond boundaries in looking for new ways and means to speed up the process with no compromises. This white paper focuses on how manufacturing processes can be improved substantially.

The potential to improve the current process of manufacturing is immense. For example, mobile and cloud have shown us the way for betterment. So where are we heading to? What can be the future of Manufacturing?

2. INTRODUCTION

There have been substantial developments in making the product better by improving manufacturing technologies; however these technologies don't reap the desired benefits unless implemented to their fullest capability and capacity.



There is a push to make these technologies simple so that the rate of realization could be quicker and faster. To substantiate this, a Sandvik example talks about the Skiving technology (Machining of Gears). Skiving was patented in the year 1905 but it took 105 years (2010) to make it a reality.

Manufacturing was always associated with skill. This includes, the skill of the operator controlling the machine, the skill of the programmer developing a software program and so on and so forth. The skill to excel in one particular technology was overtaken by multi-skilling, which made better use of workforce. With the advent of multi-skilling and Lean, there came a challenge of how to retain the skill level up to the desired level without compromising the quality of the product or rate. The answer is Automation. This aims to cut human intervention and to achieve repetitive output with greater accuracy.

Automation for Efficiency Magnification of an Operation

Multitasking was the trend when automation was first thought of. For instance a Turning machine supporting Milling and a Milling machine being able to support different setups (5 axes). A similar kind of approach was adopted for CAM systems as well. A CAM software has integrated software (both CAD & CAM), to support different setups in just one platform. This enabled the user to explore quite a lot within the software. This also exposed many loose ends, which had to be tied down such as the original information being accessible enough to be modified by a CAM user. PLM software was an answer to it. However Machining relies on the skill of a CAM Operator, such as how fast one can come up with the program and check its quality.

This gives an opportunity to take customization to an entirely different level and to be specific at the same time. The software in-built with lot of optional variables allow the user to customize it, as per the requirements. One of which is, implementation of certain degree of automation with CATIA V6 and NX7.5 – Machining Knowledge editor. Likewise the software has been customized to serve the ever growing needs. The evolution of intelligent software to simulate and to verify the programs created by the programmers has become extremely important than ever.

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3. BACKGROUND:

Advancements in metal removing has been researched world-wide by reputed institutions such as AMRC, DMDII (UI Labs), funded by industry majors and governments.

There has been increasing demand to shorten the new product development (NPD) time. In the U.S, the National Network for Manufacturing Innovation (NNMI) is working with six major research institutes to spread new manufacturing technologies in the market with an intent to answer the need of crunching NPD time. Same is the scenario elsewhere in Europe or Asia-pacific. Though PLM integrates all the product lines into one platform, it fails to address growing demand on 100% RFT with skewed timelines. On one hand PLMs & PDMs give insight into production data management systems and links product design with manufacturing under one umbrella. But they are still not up-to terms with managing huge amount of know-how associated with the product, which is essentially the feedback system and its integration to develop a better product for future and to prevent repetitive errors. The transformation of implicit to explicit knowledge is considered as the mantra for future success. The feedback system is quite essential in addressing the delays for next new product launches. The knowledge integration plays a key role in bringing about the change, much needed in the industry now. Products being sourced from different parts of the world have made the task of gathering the knowledge even more challenging. The know-how emerging from different areas of manufacturing processes, sites and departments need to be merged. Hence this research is the driving force behind implementation of knowledge based factory flow for the future.

QuEST with its diversified portfolio and robust knowledge portals has brought together much needed knowledge pool in one area. This not only contributes in progressing the customer relationship but also contributes to valuable research for future technologies.

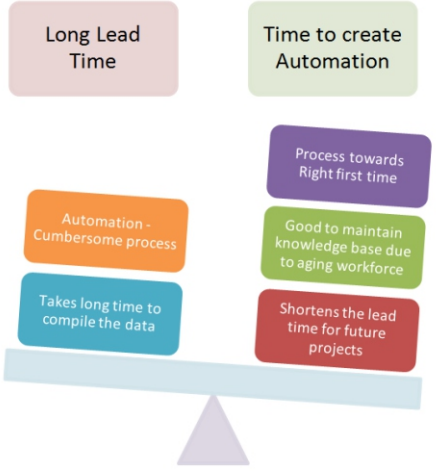
One such emerging area appears to be **Simulation** technologies. Joining hands with PLMs enables the optimization of manufacturing process before it leaves for shop and further supporting the ramp-up phases. This is one convenient alternative to shorten the development time and for cost reduction.

4. NEED

Need for new technologies to improve manufacturing processes arises from one's objective to rise above the competition. Competition is key in driving industries to go beyond boundaries in search of new technologies.

One of the key customers had an issue in meeting the deadlines with New Product Development.

Potential causes were identified upon analyzing the problem. The root cause was attributed to the delays in manufacturing launches.



Two key points were noticed.

- Longer lead times to plan a process
- Issues in achieving Right First Time in the manufacturing shops

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On weighing the pros and cons of Automation, it is evident that it brings in a changed perspective towards manufacturing in current times. Though digging into past data can be cumbersome, it helps steering the current trend in seemingly the right direction. Although the workforce keeps retiring, the knowledge remains alive!

5. PROPOSED NEW METHODOLOGY & SOLUTION:

Automation: Automation brings intelligent, flexible, reliable and highly efficient techniques to the manufacturing industry.

Sustainability:

"Sustainable development is one that meets the current needs without compromising on the ability to meet future needs".

This is a not an easy goal, nevertheless straightforward. Primary focus should be energy-efficient manufacturing. Manufacturing engineers dream of factories that operate continuously in the dark and don't need to be heated or cooled because they are run by machines. Nowadays small but highly automated factories have become more common due to which re-manufacturing and re-cycling techniques have gained popularity. The solution lies with automating your setup, which brings us to the doorstep of robots. As robots become even more widespread, they're becoming more economical, too. Industrial robots function 24/7, with greater repetitive accuracy and increasingly fine precision in less space. Their progress can be reported accurately, improve when their performance is tested for efficiency and can be fitted with advanced sensor systems for enhanced performance. First step towards this is to convert the legacy data to digital data and work on the improvements.

Here's an example of how we enable our customers to get one step closer to automation through conversion of legacy data to digital data.

Case Study:

Digitizing the Legacy data

SCOPE

Scope: Convert the 2D legacy data to 3D digital data and create manufacturing Tool path using NX and link it in Teamcenter.

Tools Used: NX CAD / CAM software, Teamcenter, post processor, NC Viewer, Vericut.

APPROACH

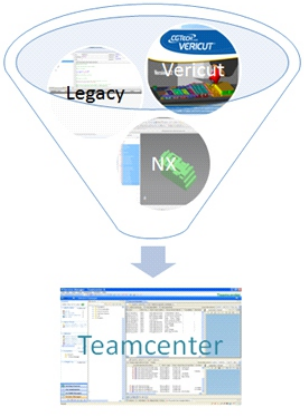
1. Study input hard copies / scanned images, process sheets & NC programs
2. Create models and drawings using NX CAD zapplication
3. Verify the 3D models and drawings
4. Create NX Tool paths in line with manual NC tapes
5. Output the NC programs using customized post processor
6. Compare the output program with original program using NC Viewer.
7. Check the program in Vericut for collision, gouge, excess material etc,.
8. Upload the files in Teamcenter.

BENEFITS

Delivery: Digitized data in Teamcenter. NX Models, Drawings & NX Toolpath

Benefits:

- Complete digital environment
- Data can be studied for improvement
- Avoid duplication One step closer towards Automation



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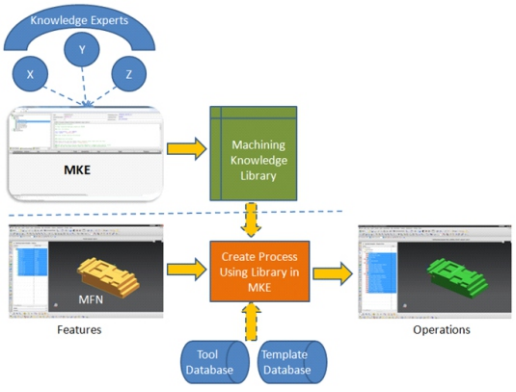
Technology:

CAD tools have been part of engineering for many years now. The tools are being used not only in product designing, but also to verify and improvize them digitally, which is quite extensively used to bypass laborios, expensive and painstaking manual testing. 3D Scanners, Printers are emerging as new ways of prototyping and changing the concept of Design and Validation. Likewise, in the area of Manufacturing and CAM there has been development to make it simpler, easier and faster than ever before. Newer versions of NX CAM / CATIA / Solid CAM etc., are adopting newer technologies with more sophistication to arrive at the solution much faster. One such tool is Machining Knowledge Editor.

QuEST has been working with customers to bring this technology to make things much faster, better and reliable.

NX CAM has Machining Knowledge editor to customize. Similarly i-machining 3D can be customized from Solid CAM, Component Application Architecture (CAA) from CATIA. Ultimately all of this sophistication helps us manufacture a product, which has a certain set of features to be machined. The software enables the user to pick and place a tool path that is required for the feature or for the part to be machined achieving the desired product with great precision.



Case Study:

Title: Feature Based Machining Template Creation – FBM using Machining Knowledge Editor (MKE)

SCOPE

Scope: To speed-up the programming time in NX for the new product.

Tools Used: NX-CAM, Machining Knowledge Editor, Vericut, Microsoft office.

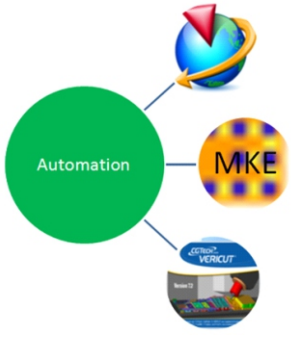
APPROACH

1. Identify the common part families
2. Identify similar feature available in the part families
3. Create ideal tool library
4. Create ideal tool path
5. Populate specific Speeds and Feeds
6. Do Feature Mapping for common identified features
7. Update Machining Knowledge Create Template file

BENEFITS

Delivery: Template File, Updated Machining Knowledge XML, Work Instruction Document

Benefits: Shorten Lead Time by 60%, Knowledge pool in one place, Part Family grouping, Easy transition of Data



Simulation:

"Simulation acts as a kind of map-in-time, visually and viscerally demonstrating the repercussions of many different decisions!"

This is another area of concern! Few customers want to adopt 100% check of programs offline and cutting the material directly with no dry runs or wax cuts. It's a tall ask since the material behavior at various stages could be different and using the right tool for the right amount of time is also limited based on trial and error. The software currently available in simulation have tried to address most of the problems related to collision or Gouge or Excess material. However, it still needs more sophisticated

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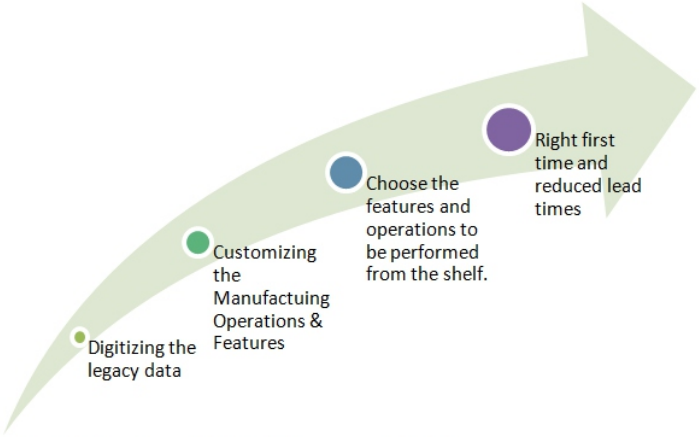
customization techniques depending upon the type of machine and controller being used by the industries. The efforts involved in chip removal and probable wear and tear is going to dictate the technology in the future.

The software such as Vericut & NCSimul do the job pretty well in checking the program for collisions, gouge check and excess material. QuEST is already supporting various customers on validating the programs and catering to the needs of the industry. QuEST, as an organization have rich minds and strong skill set to cater to ever demanding environments.

The Simulation software need certain level of customization in terms of Machine building and kinematics specific to the machine being used in the shop-floor and type of controller and its customization. QuEST having catered to similar kind of projects, is uniquely placed in the market. Teams are equipped with ready to use solutions to bring in the desired change in the Industry.

The solutions go beyond customization. Recent developments in analyzing the software, has given a new insight into the toolsets, providing the data, which is close to real time effect. Software such as AdvantEdge, has provided better solutions, which are unbelievably close to real time and meeting industry requirements. QuEST with its efficient engineers placed in different geographies has been exposed to technologies such as AdvantEdge, thereby bringing in great value in serving different customers.



"Quality is always the Best Business Plan!"

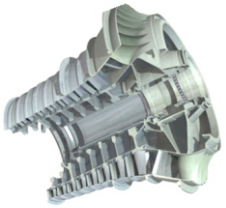
Case Study:

Title: Improved Verification of NC Program – AdvantEdge & Customized Checking Tools

SCOPE

Scope: Verification of NC program to be done entirely outside the machine. No scope of utilizing machine for dry run or wax cut.

Tools Used: Vericut, AdvantEdge, NX, Microsoft Excel & Word



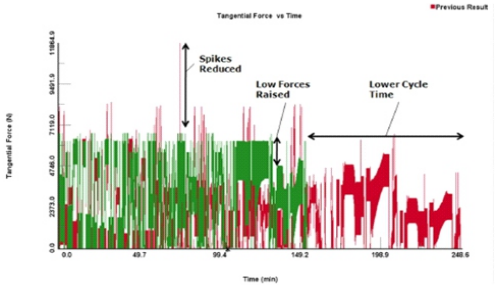
APPROACH

1. Identify the program requirements, for example, Tool Collision, Gouge, excess material, measuring cycles, Tool eye, Tool wear identification, Tool Life, Compensation for wear & part measurements, Special N no's etc.
2. Segregate the requirements depending on the capability of the verification tools.
3. Customize the Vericut controller for special function check.
4. Customized tool in Excel and Word for specking special cases like N no's, Probe codes, Coolant codes, Messages, etc.
5. Check the program in Vericut for Collision, Gouge, Excess material, etc.
6. Check the program for tool life, tool wear, Stress, etc,.
7. Feedback to NX programmer.

BENEFITS

Delivery: Completely verified program to check with all the shop requirements to avoid dry run or wax cut.

Benefits: Shortened Manufacturing & Development lead time, Error free programs, Saved time in terms of rework or tool breakages.



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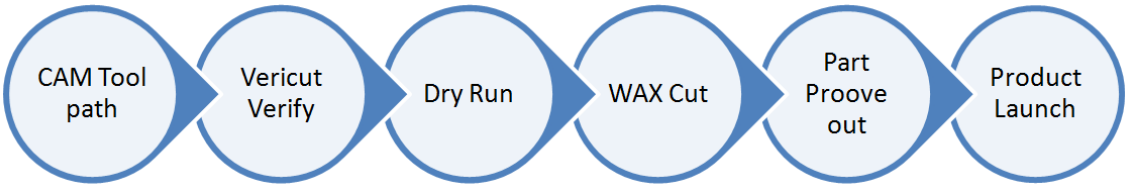
Before



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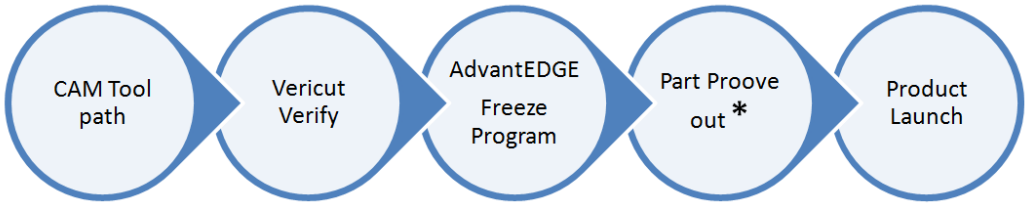

*To Validate

6. SCOPE OF IMPROVEMENT:

There is much more scope to improve. The open ended architecture brings more and more innovative thinkers to be creative with customization. The product needs to be used in other areas of manufacturing support. The CAD / CAM have limited usage Robotics and actual implementation in shop. Though few controls take the CAD / CAM to Shopfloor, there is lot more to improve in terms of hardware at shop level. Also integrating real time data and designing intelligent system is one another area of improvement.

There are many types of software for different applications; the logic to interface freely with interdependent softwares is another area where more improvement is needed.

7. BENEFITS:

Innovation in technology implies to put technology to its fullest use. Well customized and point-to-point solutions to a range of issues, shortened developmental lead time brings about the much needed breathing space to designers to explore and validate their designs much faster, with reduced visits to the shop floors.

There are cases where only 1% to 2 % of the designed products going to production phases. The solutions discussed above, give the designers an opportunity to look for better technologies with faster turnaround time (TAT).

QuEST with its up-to-date technology mindset, working with leading industries has put itself in the league where it can think of offering solutions off-the-shelf depending on the requirements of the customers from various verticals.

Quantifying by applying QCDS – (Quality / Cost / Delivery / Safety) the following direct benefits could be anticipated with the use of newer technologies:

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1. Quality Improvement:
    a. Reduced Rework / Rejections
    b. Reduced surface finish issues due to improved monitoring of tool cutting edge
    c. Reduced uncertainties

2. Cost Efficiency:
    a. Improvement in tool life
    b. Reduced cost on infrastructure investments
    c. Reduced cost on manpower recruitments

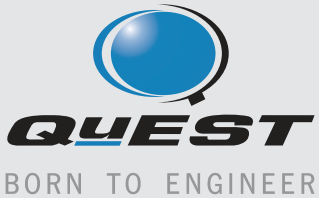
3. Time Reduction
    a. Overall new product development time by 5 % to 30%.
    b. Design evaluation time
    c. Part prove-out time reduction in shop floor.

4. Safety
    a. Avoids Tool Collisions
    b. Gouge free programs

There are more benefits. Improved customer base with launch of newer products, reduced stress in environment, increased scope for research, better usage of software, highly automated factories… the list goes on.

8. MEET THE AUTHOR:

Uday K Mohandas has been in the Manufacturing Industry for over 18 Years. He has worked with world's major industries such as Toyoda, Rolls-Royce, MAG Automation, GE Aviation, Dassault Aerospace, Kawasaki Heavy Industries etc., to name a few. He has successfully led engineering teams to launch New Product Initiatives for leading Aerospace Companies such as Boeing, Airbus, Rolls-Royce, Snecma, Magellan Aerospace, Marshall Aerospace, Avio & Automobile Manufacturing Companies.



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