GHSP's DFMA Transformation
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GHSP (which used to stand for Grand Haven Stamped Products, but since we no longer do stampings, it's just GHSP) is a manufacturer of automotive products. Our core products are Shifters, Electric Pumps, Controllers/ECUs, and Actuators. In 2020, GHSP moved it's headquarters to Holland, Michigan (30 minutes south of Grand Haven) due to outgrowing the Grand Haven facility and not being able to find a building suitable for GHSP in Grand Haven. GHSP is a global supplier, with manufacturing facilities in Hart, Michigan; Grand Haven, Michigan; Saltillo, Mexico; and 2 facilities in Shanghai, China; Sales and Engineering in Japan; and Engineering in India. We supply products to many OEMs to include GM, Ford, Stellantis, Toyota, Honda, Saic, FAW, Geely, BYD and some Teir 1 companies.

Before 2016, GHSP's DFMA process was just a single task in their Product Development Process. It usually consisted of a Mechanical Engineer and a Process Engineer reviewing the design in CAD. The process had no structure and was only about 1-2 hours long. It mainly was just to put a check in the box for the Mechanical Engineer. But in 2016, the Director of Central Manufacturing knew that the DFMA process was very important and needed to be improved, in order to give the manufacturing teams a voice in the design. He then created an Excel file that provided some sort of structure for evaluating the design. This form also required that it be signed-off on by the Plant and Launch Managers. This was a step in the right direction, but in his research to create the file, he stumbled upon Boothroyd Dewhurst's website. A team of 5 GHSP took a trip to Rhode Island and spent 3 days using the DFMA software, evaluating one of GHSP's newest shifters. It was easy to see the benefits of the software and shortly after the team returned to GHSP, they purchased the software. They have since then been using the software on over 50 potentially new products.

Success stories:

1) GM SIB's: The original design consisted of 2 PCBAs, each with a ZIF Connector. The 2 PCBA's we connected to each other via a Flat Flexible Cable (FFC). Due to a very difficult assembly process (which GHSP had no experience doing), with quality/warranty and ergonomic concerns, they used the software to add data to many potential new solutions. Eventually they settled on a Board-to-Board style of connector, that would directly

connect the 2 PCBAs to each other, eliminating the FFC. Though this change would add $0.09 Piece Price to each part, it saved $0.24 in Assembly Process time. Therefore, the net savings was $0.15 per part and with a Life Volume of 2,867,800 parts, that is a Total Life Cost Avoidance of approximately $430,000.

2) Ford 1T50: The original plan was for GHSP to assembly the Rotor, which consisted of a Core, a Shaft that was pressed into the Core, and 4 Magnets (which were glued to the Core, therefore requiring an Activator and an Adhesive that would need to be applied and required a 60 second drying time). This sub-assembly would then need to be placed into a plastic injection molding machine where a plastic overmold would be added around the Magnets and Core. This was not a normal assembly process for GHSP, as previous Rotors were purchased components. Using the DFMA Software, GHSP established what the cost would be if they assembled it vs purchasing the Rotor. The software showed that it would be less expensive to purchase the Rotor. This decision had a cost avoidance of $1.81 for Assembly Process time and $1.13 for Piece Part cost. The net savings was $2.94 per part and with a Life Volume of 1,380,000 parts, that is a Total Life Cost Avoidance of approximately $4,096,000. There was also Capital investment cost avoidance, as they did not need the assembly equipment to assemble the Rotor.

3) Stellantis TCSM: GHSP was able to implement 5 ideas on this project. The top 3 ideas were reducing 4 individual Light Pipes down to 1, reducing from 8 Screws down to 4, and combining 7 Light Pipes with 7 Plungers to remove 7 components off of the BOM. Implementing these 3 ideas created an Assembly Process time savings of $0.24 per part and a Piece Part savings of $1.01 per part. The net savings was $1.21 per part and with a Life Volume of 2,000,000 parts, that is a Total Life Cost Avoidance of approximately $2,410,000.

4) Stellantis Pursuit: The original design had a Wire Harness that the customer would connect the Shifter Knob to. But they also had to connect the vehicle wire harness to our part, so we felt that we could remove our Wire Harness and just have the OEM add a small jumper to their vehicle wire harness to connect the Shifter Knob to. This would enable us to remove the Wire Harness, therefore lowering our cost to them. We normally would not have thought about this, but due to us labeling the Wire Harness as a

"Connector", the DFMA software highlighted it as a candidate for removal. Therefore, we approached the customer with the idea and they agreed with us. This saved us $0.19 in Assembly Process time and $1.28 in Piece Part cost. The net savings was $1.47 per part and with a Life Volume of 720,000 parts, that is a Total Life Cost Avoidance of approximately $1,056,000.

5) Metrics Page: Another success for GHSP was implementing a SharePoint DFMA page. This would be a 1 stop spot for everything related to DFMA for GHSP employees. And as part of this page, it included metrics related to the DFMAs at GHSP. By using Power BI, the metrics are interactive, allowing the viewer to sort the data to their preference. The metrics allow for easy reference when questions about the benefits of DFMA arise.

Recommendations for New Users:

1) 3 days can be a lot, especially if you have products that are very similar to each other. It is ok to have 1-2 day events, but the main thing is that you must do a review on every product. One thing you can do to help speed up the process, when reviewing a similar product, is to have the BOM already created (and CAD files loaded if available) prior to the meeting.

2) Due to Covid, we had to start doing online DFMAs. This is ok but limit each meeting to 2 hours. And schedule those meetings (because you're going to need more than one) either 1 in the morning and 1 in the afternoon. Or schedule them all in the morning (or all in the afternoon) for 2-3 consecutive days. But get back to doing in-person events as soon as possible, as these facilitate more collaboration and better ideas.

3) Include an Exploded View Drawing or PowerPoint of the product with the meeting invite (or in an email prior to the meeting). This will give the attendees a chance to understand/grasp what they will be reviewing prior to the meeting. And will allow them time to come with notes or potentially even ideas on how to simplify the design.

4) Once you have all your ideas documented, it is good practice to prioritize them and then assign them to a person. Once this is complete, hold regular Follow-Up (Open Issues) meetings to hold people accountable for completing those tasks. People tend to put these tasks off if they are not part of their regular workload.

5) Depending on the complexity of the product (or the amount of time developing it), you may need to hold 2-3 DFMA events on the same product. As the design progresses, ½ to 1 day follow up DFMAs may be necessary to update the design and highlight any negative (or positive) effects the changes have made.

I hope you enjoyed this presentation and potentially learned something. Feel free to reach out to me via email at taylorn@ghsp.com with any questions or suggestions you may have for me. Thanks.

-Nate Taylor