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| MxD 14-06-05 | Category: Recurring Manufacturing, PO to 1st Article, Engineering Change |
| Title: | Operate, Orchestrate and Originate (O3) |
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Summary:

O3 discovered that to enable digital twin manufacturing, the digital thread should include a standard to model the product being manufactured, a standard to report the actions of the manufacturing machines, and a standard to document the quality of the manufactured results.

Three standards are necessary because the three functionalities require different technologies. The first needs to be extensible because products and technologies are always becoming more complex. The second needs to be responsive because manufacturing machines are always becoming faster. The third needs to be descriptive because quality problems are fixed more quickly when the issues are described more precisely. Therefore, O3 selected the following three standards for its digital thread

1. STEP for modeling product data.
2. MTConnect for streaming process results.
3. QIF for documenting manufacturing quality.

For a manufacturing task these three standards must be coordinated within a framework. The O3 project found that this coordination can be managed using universally unique identifiers (UUID's). Key entities in the STEP models were given these identifiers using a recent extension to the file format of STEP. The same entities were then referenced in the MTConnect data stream using the same identifiers. Finally, at the end of the measurements the results were communicated back to the digital twin by a QIF file that had the same identifiers in its QPID attributes. The result was shown on the model as red, green and yellow tags on the digital twin.

The O3 BIP is deployed at Boeing on 30 machines and is used for production on every new airframe. Significant demonstrations of the technology will be given at IMTS 2018. Four machine tool vendors and two CMM vendors are planning to participate.

Videos showing the results of the O3 project are here:
https://youtu.be/Mjzg5nku5Lg
https://youtu.be/n_syXtpyxgM