

New NIST Test Bed Makes the ‘Digital Thread’ Accessible: Model Factory Provides All-in-One Toolbox for Exploring Digital Manufacturing

Researchers at the U.S. Commerce Department’s National Institute of Standards and Technology (NIST) celebrated Manufacturing Day on October 7, 2016, by launching the [Smart Manufacturing Systems \(SMS\) Test Bed](#). The test bed is an innovative model factory that will facilitate the advanced manufacturing technology known as the “digital thread” and help manufacturers cut costs, shorten production time, reduce errors and provide higher quality goods.

“The SMS Test Bed joins the many resources NIST offers to help U.S. manufacturers drive innovation and compete in a global market,” said Under Secretary of Commerce for Standards and Technology and NIST Director Willie E. May. “Digital manufacturing represents an exciting advance that is expected to yield significant operational and bottom-line benefits for manufacturers of all sizes.”

Until recently, manufacturers have predominantly used two-dimensional (2-D) drawings—what we know as blueprints—in either printed form, computer-aided design (CAD) plans or a combination of both to guide a product through its life cycle. Because these methods require humans to interpret, translate, re-enter and transmit data at each step in the process, there can be significant expenditures of time and money, as well as multiple opportunities for errors to occur. In spite of the disadvantages, however, 90 percent of small manufacturers still rely on traditional 2-D methods to make their products.

The digital thread relies on standardized, three-dimensional (3-D) models for electronically exchanging and processing product and manufacturing information all the way from design through inspection of the final part. Researchers estimate that moving manufacturing from 2-D paper-based systems to 3-D digital manufacturing could cut production time by as much as 75 percent.

NIST’s SMS Test Bed is designed to make the digital thread and the resources needed to make it work accessible to all who want to explore its capabilities and contribute to its advancement. It also serves as a platform for measuring the effectiveness of standards for collecting and distributing production data that support the digital thread.

The test bed consists of three major components:

- A computer-aided technologies laboratory with a suite of standardized software tools for controlling design, fabrication, inspection, data management, and verification and validation testing;
- A real-world manufacturing facility at NIST’s Gaithersburg, Maryland, headquarters, featuring a variety of computer numerical control (CNC) machine tools (such as milling and turning centers) and precision inspection devices (such as coordinate measuring machines and digital micrometers); and

- Online data streaming, collection, storage and publication services that provide real-time, universally compatible data links for experimenting with the digital manufacturing process; a searchable repository of all SMS Test Bed data generated; and preset data packages for model products previously fabricated using the digital thread that manufacturers can try at their own facilities.

“The goal of the SMS Test Bed is to create a shared resource that enables smart manufacturing research and development,” said NIST mechanical engineer [Thomas Hedberg](#), co-coordinator of the project. “We are actively seeking collaborators who are willing to link their manufacturing data sets, fabrication processes and product data exchange systems with our test bed so that we can help them make their way toward digital manufacturing, and at the same time, let others who participate in the project gain from their knowledge and experience.”

According to NIST mechanical engineer and project co-coordinator [Moneer Helu](#), future plans for the test bed include offering manufacturers the opportunity to compare the fabrication of test products (with preset designs and datasets) using their standard procedure and with an optimized “digital thread” plan. “We also hope to assist with the creation and launch of test beds like ours across the country so that eventually, a national network is established,” he said.

To establish the SMS Test Bed, NIST is working with the Association for Manufacturing Technology (AMT), an organization that represents and promotes U.S.-based manufacturing technology; DP Technology Corp., a developer and supplier of computer-aided manufacturing (CAM) software; Mazak Corp., a maker of advanced machine tools and automation systems; Mitutoyo America Corp., a maker of measurement equipment and software; the MTConnect Institute, a standards development organization; and System Insights Inc., a provider of predictive analytics software for manufacturing.

Researchers from academic institutions and public-private consortia have already begun using data available from the SMS Test Bed, including: Rensselaer Polytechnic Institute, Virginia Tech, the Commonwealth Center for Advanced Manufacturing (CCAM) in Virginia and the Digital Manufacturing & Design Innovation Institute (DMDII) in Illinois. DMDII is a member of the Manufacturing USA network, which NIST supports through the Advanced Manufacturing National Program Office.

For more information on the SMS Test Bed, visit the [SMS Test Bed webpage](#) or send a message to smstestbed@nist.gov (link sends e-mail). Two videos about the “digital thread” and its potential benefits for manufacturing can be viewed here: <https://www.nist.gov/news-events/news/2016/10/new-nist-test-bed-makes-digital-thread-accessible>.

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