

## Industrial machinery and equipment

# Eisenmann

## Developing an automated flight service cart system for New Doha International Airport

### Products

Tecnomatix, NX, Teamcenter

### Business challenges

Gain bigger market share through innovative products

Deliver a monorail system for food catering carts at the New Doha International Airport

Shorten final onsite throughput testing

### Keys to success

Simulate the automated material flow of complete operations

Virtually commission electrified monorail systems

Optimize complex material flow systems

Easily build a discrete event simulation model

### Eisenmann shortens project delivery time by conducting virtual commissioning using Plant Simulation

#### Virtual commissioning enabled by Plant Simulation

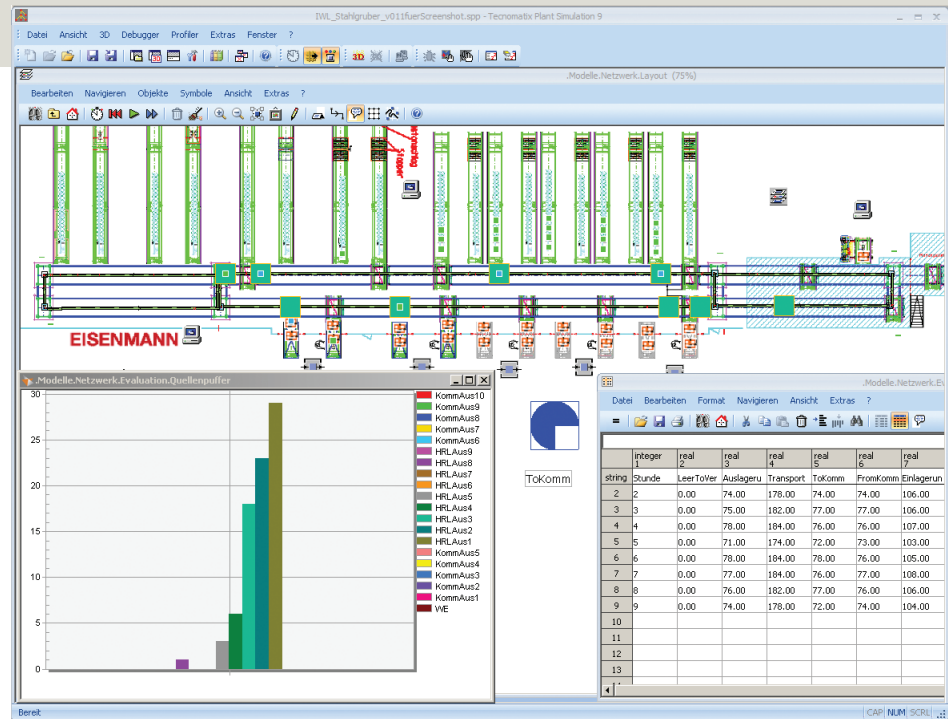
The process of testing a facility or plant to verify that it functions according to specifications is called commissioning. Advances

in technology have made it possible to conduct significant portions of this testing using computer systems, which simulate in great detail the plant's operation. Eisenmann Conveyor Systems (Eisenmann) is using Siemens PLM Software's Plant Simulation solution in the Tecnomatix® portfolio to simulate such testing virtually, hence the term, "virtual commissioning." This process can save companies substantial amounts of time and money by



Eisenmann electrified monorail system.

This model created using Plant Simulation shows an inverted monorail system, including the monorail layout, a bar chart showing the order queues, a circular chart showing the level of empty trolleys and a table showing the hourly throughput values.



## Results

Designed and built the New Doha International Airport's electrified monorail system  
Determined optimal number of trolleys and buffers  
Shortened final throughput testing through virtual commissioning validation

modeling and optimizing operations long before construction or equipment installation begins.

Eisenmann builds facilities for surface finishing technology, material flow automation, environmental technology and ceramics firing lines, as well as special facilities for energy recovery, coating, thermal processing and recycling. Eisenmann uses software tools from various product lines of Siemens PLM Software. Hundreds of Eisenmann engineers use NX™ software for product design and Teamcenter® software for product lifecycle management (PLM). In the area of digital manufacturing, Eisenmann uses Robcad™ software in the Tecnomatix portfolio for 3D simulation of paint production processes, as well as Plant Simulation for discrete event simulation of paint and logistic lines.

### Electrified monorail system for fast, automated inbound logistics

An electrified monorail system (EMS) is a rail-bound means of conveyance with individually driven trolleys that move independently on the rail system. Branch points can be implemented on the line

with the aid of switch points. The actual rails are typically attached to the shop ceiling. If a trolley fails, it can be slid from the transport line into the maintenance bay without major effort.

Eisenmann uses Plant Simulation extensively in the company's Conveyor Systems business unit. The expected target of each simulation is defined with the customer. The objectives to be pursued differ, depending on the project phase, and may include the development of new concepts and visualization of material flow; project planning support by material flow confirmation and determination of the number of trolleys; and execution support via impact analysis of malfunctions and by testing material flow strategies and contingency concepts.

The customer provides Eisenmann with the required transport matrix, which is actually the throughput that the facility needs to support, and where applicable, a working time model. Eisenmann develops the layout and defines the conveying characteristics, for example, the conveyor speed (in straight rail and curves) and routing strategies.

**“With our virtual commissioning capability, supported by creating realistic validations in a virtual environment using Plant Simulation, we believe we can shorten delivery time on every project.”**

Ralf Weiland  
Senior Vice President Conveyor Systems  
Eisenmann

*“We are very pleased with the discrete event simulation capabilities we have developed in Eisenmann throughout the years, especially our use of Plant Simulation.”*

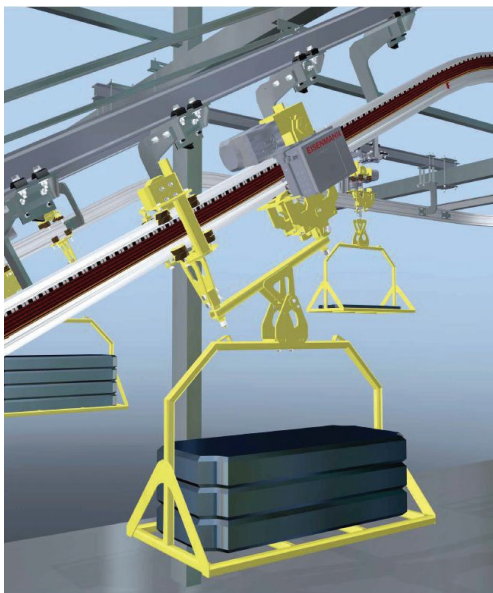
Dr. Monika Schneider  
Simulation Expert  
Conveyor Systems  
Eisenmann

“We are very pleased with the discrete event simulation capabilities we have developed at Eisenmann throughout the years, especially our use of Plant Simulation,” says Dr. Monika Schneider, simulation expert at Eisenmann Conveyor Systems. “Typically, the results we get from the simulation include confirmation of the required throughput and the required number of trolleys, which have a strong impact on project costs; confirmation of the layout design; capacity utilization of conveyor system components and stations; occupancy of buffers and queues; and the impact of planned routing strategies. Based on the simulation results, appropriate project documentation is generated.

“Examples of Plant Simulation capabilities, which are fundamental for our usage, include our own object libraries,” says Schneider. “These libraries allow us to build a basic simulation model in half a day, with the ‘Pack-n-Go’ functionality, enabling us to deliver a dynamic simulation model.”

#### **Testing a logistical masterpiece – virtually**

As a future hub of international air traffic, the New Doha International Airport (NDIA) in Qatar set out to create a smoothly functioning, reliable logistics system. NDIA



*Electrified monorail system designed using NX.*

Food cart being loaded onto the trolley.



**"The simulation model we create with Plant Simulation is often part of the deliverable to our customers. Many of them also use Plant Simulation themselves, so they know how to run the simulation and change the needed parameters. This is a big benefit for them, because they get a virtual model of the physical line."**

Dr. Heiner Träuble  
Simulation Expert  
Automotive Paint Systems  
Eisenmann

selected Eisenmann to install an EMS, linking all operational stations in the new state-of-the-art catering wing and assuring the airlines' supply of flight service carts. These carts will provide the airplanes with food, drinks, duty-free articles and newspapers. Within this exceptional airport, the carts of all arriving and departing airlines will be processed on schedule and to rigorous standards.

With 130 trolleys and roughly 20,000 transports per day, the 1.6 kilometer long electrified monorail from Eisenmann lies at the heart of this logistical masterpiece. The monorail will effectively and efficiently link the various process steps involved in this delivery system, including all the measures necessary to clean and equip the carts.

Carts arriving in the incoming area will be manually pushed onto the waiting EMS trolleys and transported to the supply station, where they are emptied. The empty carts on the EMS trolleys will pass through the cleaning zone, and then proceed to the various terminals. The corresponding destinations will be specified by the material flow computer (MFC) from Eisenmann.

At the terminals, the carts will be loaded with fresh goods and food. Approximately 82,000 meals will be produced and distributed every day.

"In the NDIA project, we have used Plant Simulation intensively," Schneider says. "We started with the 2D layout of the catering building, and built a simulation model that runs an animated simulation on this layout. For the quotation phase, in which we had to fix the number of trolleys and lifting stations, the track length and other parameters, we simulated a peak scenario. The material flow starts from the incoming area to the 'main highway,' through which all the trolleys are going. Special attention was given to the routes of empty trolleys, according to priority rules, in order to prevent blockage of trolleys by other trolleys during low profile times.

"In this project, we practiced for the first time with a virtual commissioning concept, by connecting the MFC to the simulation model, and thus we were able to identify and resolve most of the problems in the MFC program. You can actually visualize any improper material flow in the virtual simulation model. I worked on this side-by-side with a control programmer, who developed and debugged the control programs. As we set up this connection for the first time, we were rather impressed, because everything worked as documented."

#### **The complexity factor**

"This project was complex in the sense of the relatively many routing strategies that we had to develop," says Dr. Ullrich Ochs, senior manager, Software – Electrical Engineering, Eisenmann Conveyor Systems. Dr. Ochs, who manages the control aspects of the NDIA project, explains, "When developing that many routing strategies, the control programmer needs to forecast virtually any possible scenario, and this is a real challenge. So

we decided to use Plant Simulation for the virtual commissioning. Using the joint work of the control programmer with the simulation expert who configured and used Plant Simulation, we created a virtual commissioning setup, in which we were able to identify and solve real problems with our routing strategy control program. The kind of issues we identified using the virtual commissioning setup included, for example, a trolley that didn't arrive at the designated station and the size of the buffers for empty trolleys (which was incorrect).

"In the final step of a project commissioning, we usually conduct a throughput test, in which we physically run the line for several hours, typically an entire shift, with all the shop floor people. Connecting Plant Simulation to the MFC, we were able, for the first time, to conduct some of this testing virtually in the office. More importantly, this means that the real commissioning effort was smaller. Because real onsite commissioning is expensive, this capability has the potential to greatly impact the competitiveness of our offering in terms of cost."



*Automotive subassembly paint line delivered by Eisenmann.*

#### **Resolving complex challenges in automotive paint lines – virtually**

Eisenmann also uses Plant Simulation in its automotive business unit to simulate various kinds of production lines, such as paint shops and overhead monorail systems that deliver parts to assembly lines and automated guided vehicle (AGV) systems. Typical input parameters for the simulations include the layout of the plant, such as geometry and topology; technical parameters, such as speeds and acceleration; and logistical parameters, such as requested throughput, shift pattern, mean time to repair (MTTR) and availability.

"In the automotive business unit, we are using Plant Simulation to create simulations at different levels of detail, depend-

*"We have a long legacy of using Plant Simulation in the automotive business unit of Eisenmann, and we are very pleased with it. We sometimes use other solutions, as requested by our customers, but Plant Simulation really stands out as a superior solution that fits our needs."*

Dr. Heiner Träuble  
Simulation Expert  
Automotive Paint Systems  
Eisenmann

**"...we use Plant Simulation in nearly every project. We start by using Plant Simulation in the quotation or pre-engineering phase, as well as employ it in the realization phase. We typically create one new simulation model per week."**

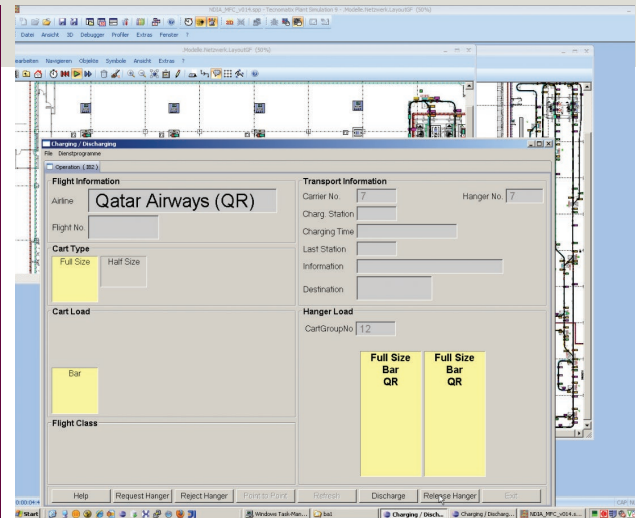
Ralf Weiland  
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“Connecting Plant Simulation to the MFC, we were able to conduct some of this testing virtually, in the office. That’s another project first. More importantly, this means that the real commissioning effort was smaller. Because real onsite commissioning is expensive, this capability has the potential to greatly impact the competitiveness of our offering in terms of cost.”

Dr. Ullrich Ochs  
Senior Manager  
Software Electrical  
Engineering  
Eisenmann

*User terminal screen and model created using Plant Simulation during the virtual commissioning of the NDIA project.*



ing on the project phase,” says Dr. Heiner Träuble, simulation expert, Automotive Paint Systems, Eisenmann. “In the concept phase, we mainly analyze the size of buffers before and after the paint line. The details of the conveyors won’t usually be handled at this phase. During the planning phase, the generic buffers will be changed to discrete conveyors. The scope of analysis will typically be the cycle time of the discrete conveyors and flow strategies. Sometimes, after several years of operation, a production line will need to be rebuilt. Then we use the simulation model we created when delivering the line to show the impact of the changes.

“The simulation model we create with Plant Simulation is often part of the

deliverable to our customers. Many of them also use Plant Simulation themselves, so they know how to run the simulation and change the needed parameters. This is a big benefit for them, because they get a virtual model of the physical line. Some customers require us to use their own simulation standard. Moreover, selected automotive OEM customers provide us their own library of Plant Simulation objects, from which we create the simulation model.”

The targets of the simulation in the automotive business unit typically include confirmation of throughput (jobs per day), cycle time check of conveyors and in paint shops, a sequence check of the batches (sometimes called “pearl chain”). The

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## Solutions/Services

Tecnomatix

Plant Simulation

Robcad

[www.siemens.com/tecnomatix](http://www.siemens.com/tecnomatix)

NX

[www.siemens.com/nx](http://www.siemens.com/nx)

Teamcenter

[www.siemens.com/teamcenter](http://www.siemens.com/teamcenter)

## Customer's primary business

Eisenmann is a leading global provider of industrial solutions and services for surface finishing, material flow automation, thermal process technology, and environmental engineering. A family-run business based in Southern Germany, Eisenmann plans and builds made-to-measure manufacturing, assembly and distribution plants that are highly flexible, energy- and resource-efficient, and deployed by enterprises throughout the world for more than 60 years.

[www.eisenmann.com](http://www.eisenmann.com)

## Customer location

Böblingen

Germany

typical challenge is that color sorting "damages" the sequence, creating the need to measure the quality of the sequence.

Other targets include decoupling of conveying areas to analyze the impact of failures, checking conveying strategies, sorting for color blocks (in a paint shop), sorting to rearrange a sequence (such as to support just-in-sequence production), determining or estimating the number of skids and hangers, visualizing complex material flow, and discussing or developing conveying strategies in a layout or plant.

"We have a long legacy of using Plant Simulation in the automotive business unit of Eisenmann, and we are very pleased with it," says Träuble. "We sometimes use other solutions, as requested by our customers, but Plant Simulation really stands out as a superior solution that fits our needs. The software has unique features, such as defining a plant layout as a background, highly flexible programming language, very useful 'Pack-n-Go' functionality to deliver simulation models to customers, and strong library capabilities (including objects with logic), which enable us to use customer libraries as well as our own."

## Using Plant Simulation for virtually every project

"In the Conveyor Systems business unit, we use Plant Simulation in nearly every project," says Ralf Weiland, senior vice



*Eisenmann education center in Böblingen, Germany.*

president, Eisenmann Conveyor Systems. "We start by using Plant Simulation in the quotation or pre-engineering phase, as well as employ it in the realization phase. We typically create one new simulation model per week."

Weiland explains the process: "During the quotation phase, the ability to present a suggested concept to a potential customer, supported by a simulation, is unique. This helps us demonstrate the proposed concept in a visually dynamic manner, which gives the prospect more confidence that our proposed concept fulfills the requested throughput data. But the benefit of Plant Simulation is far beyond this. We actually reduce the risk associated with a line delivery by simulating any potential operative scenarios. With our virtual commissioning capability, supported by creating realistic validations in a virtual environment using Plant Simulation, we believe we can shorten delivery time on every project."

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