Using NX and Teamcenter to create cutting-edge cable-drawn transport systems enables Doppelmayr to maintain leading global market position

‘Online’ transport systems
Skiers and snowboarders using gondolas and chairlifts to get to the top of the slopes on snowy mountains, summer tourists riding aerial tramways and funiculaires to scenic viewpoints, residents and visitors of cities crossing urban landscapes, parks and airports using automated people movers, and companies using high-bay warehouses and cable-driven conveyor systems for material handling have one thing in common: they are most likely using equipment from the Doppelmayr/Garaventa group (Doppelmayr). The Austrian family business, with production facilities in Austria, Switzerland, Italy, France, China, Canada and the United States, is leading the global market for cable-driven transport systems with a 60 percent market share. To date, Doppelmayr has built more than 14,600 installations for customers in 89 nations.

Doppelmayr is the world’s leading manufacturer of cable-drawn transport systems for tourism-related and urban applications. In December 2015, the first of a new generation of continuous-movement monocable gondola and chair lift systems was installed in Austria.
Advancing innovation
Established in 1892 and manufacturing ski lifts since 1937, the group, now employing 2,500, gained its leading market position by continually setting new standards and introducing various innovations across magnitudes of scale, from heated seats on chair lifts to mixed chair and gondola lifts to “3S” tri-cable gondola system technology.

Out of the extensive Doppelmayr portfolio, the best-selling and most wide-spread product is the continuous movement monocable lift with detachable gondola cabins and/or chair hangers. The company installs 50 to 70 units each year. First introduced in 1972, Doppelmayr engineers have continuously improved this system by adding and replacing components and subassemblies with newly developed, innovative alternatives. There was a threat that the feasibility of further improvements to the time-tested system would reach boundaries set by decisions made decades ago. To advance the validity of the concept for many years to come, in 2011, Doppelmayr management decided to commence development of an all-new generation of detachable gondola and chair lift systems called D-Line.

Results (continued)
Achieved successful operation immediately upon initial installation
Maintained manageability of millions of designs over prolonged periods

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Dirk Czerwinski
Technology Process Coordinator
Doppelmayr

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Technical Director
Doppelmayr

Transport capacity of the new D-Line system exceeds that of its 1988 predecessor by about 50 percent while station buildings are 20 percent shorter and offer easier maintenance for operators.

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Doppelmayr engineers created designs using a new and different approach for the drive pulley as well as the conveyor system transporting the cabins through the station while detached from the cable, reducing noise and vibrations to negligible levels. To reduce noise, vibration and undesired side movements, Doppelmayr engineers created designs using a new approach for the drive pulley and conveyor system that transports for the cabins through the station while detached from the cable. The result is impressive: the D-Line station is 20 percent shorter than its 1988 predecessor, although its cabins hold four more passengers (10 versus six) and its speed has increased considerably.

Joint engineering effort for more than 200 innovations

“Creating this new premium product line was a joint effort of design engineers across various locations in Austria, Switzerland, Italy, Canada and the United States,” says Dirk Czerwinski, former design engineer and now technology process coordinator at Doppelmayr. “They utilized NX and Teamcenter software from Siemens PLM Software more extensively than ever before.” Doppelmayr has been using Siemens PLM Software tools for all

The first installation of a D-Line gondola lift was completed in December 2015 in Hochgurgl, Austria. “Our engineers have implemented more than 200 innovations, 31 of which are brand-new significant design features,” says Christoph Hinteregger, technical director at Doppelmayr. “We managed to create a system that can move larger and heavier cabins faster while offering easier maintenance and greatly reduced noise and vibrations, as well as smaller stations.”

The new cabins, destined to become an industry standard, are wider than anything that ever was attached to the cable of the previous system generation. This required extending the cable gauge to 6.4 meters. Carrying up to 10 passengers, these cabins are also heavier. This and a top speed of 7 meters per second, combined with a 45 degree incline, can make it necessary to use cables with diameters up to 64 millimeters. Achieving a secure grip on these cabins also meant fully redesigning the patented cable clamp, the central element of the system. "Using NX within a Teamcenter environment ensures a common knowledge base and unerring workflows, so we can create parametric models consisting of tidy sets of data. This is particularly helpful as we frequently have to alter existing designs many years after they were first created.”

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mechanical design and development work since 2005, accelerating engineering throughput impressively compared to the solutions the company had previously used. Doppelmayr started with 10 NX™ software licenses in 2005; by early 2016, that number had grown to 200.

Doppelmayr design engineers collaborate using a multi-site installation of Teamcenter® software. “Using NX within this environment ensures a common knowledge base and unerring workflows, so we can create parametric models consisting of tidy sets of data,” says Czerwinski. “This is particularly helpful as we frequently have to alter existing designs many years after they were first created.”

Doppelmayr engineers find synchronous technology especially fast and productive when importing computer-aided design (CAD) data created using other software. “This can be relevant when architectural models are part of the overall system design,” Czerwinski explains. “Likewise, we import models of the gondola cabins that were designed by our group member CWA Constructions, who has not converted to NX yet.”

Doppelmayr has a reputation for making things right the first time. “The sheer size of complex systems such as a detachable gondola or chair lift prevents prototyping in the real world,” says Czerwinski. “Using NX allows our engineers to remove every obstacle to smooth and safe operations in the safe environment of the virtual world.”

Structural analysis and multi-physics simulation are imperative. While external engineering offices supply most of this work, Doppelmayr engineers use NX advanced finite element (FE) modeling...
software in-house for preliminary sizing of their designs. This software forms the analysis modeling foundation on which the engineers can preprocess and postprocess analysis models for structural, thermal and flow, engineering optimization as well as multiphysics analyses.

They also use the tools NX provides for motion simulation and for hydraulic line routing. “We find it very helpful to be able to verify the equipment’s usability,” says Czerwinski. “To ensure this, we are using the human modeling functionality within NX.” And, almost as a matter of course, manufacturing engineers are using NX CAM to extract programs for numerical control (NC) part production machines, also providing virtual test-runs of the milling operations.

Setting standards using standards
The extensive installation of the software and its collaborative use across globally distributed engineering locations has enabled Doppelmayr to employ great discipline and clean, unified data models. This is especially important considering the frequent necessity to modify existing designs to keep them up to date with the changing availability of components.

“We are using the standard functionality of NX and Teamcenter without any modifications,” says Czerwinski. “This helps us to keep standard procedures in use at all times.” It also helps minimize the efforts required for updating to newer versions of the software used in the engineering departments. To enable agility in the case of requirements for the redesigns of existing assemblies, they perform an automatic re-filing of all assemblies following each software update.

Doppelmayr design engineers do not rely on the 3D models suppliers provide over the Internet, either. “They are often lacking features required by our modeling standards, so the three systems engineers providing NX users with support also model all standard parts, including screws and nuts from scratch”, says Czerwinski. “This affords us with the ability to create models in various forms with several different detailing levels.” Large assemblies such as entire stations consist of several hundreds of thousands of parts, so the capability of the software to enable views with various levels of detail is of great importance to keep up the performance. For similar reasons, especially speed, when designs created using their previous CAD software need to be modified, Doppelmayr engineers create new models using NX rather than importing the legacy geometric data.

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The sheer size and complexity of systems such as the D-Line detachable gondola or chair lift prevents prototyping in the real world. Using NX – including the software’s human modeling functionality – allows Doppelmayr engineers to remove every obstacle to smooth and safe operations during prototype testing in the safe environment of the virtual world.
Customer's primary business
The Austrian Doppelmayr/Garaventa group is a globally leading manufacturer of chairlifts, aerial tramways and funiculars as well as cable-drawn rail systems for tourism and public transport applications in mountainous as well as urban terrain. www.doppelmayr.com

Customer location
Wolfurt
Austria

"Straightforward installations of all software products including NX and Teamcenter are essential to keep up our engineering’s ability to innovate."
Dirk Czerwinski
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Leading the global market thanks to advanced software
Doppelmayr engineers use Teamcenter for development workflows, including all approval procedures and documentation as well as to store all product-related technical data. This data is continuously exchanged between NX and the company’s enterprise resource planning (ERP) software via a bi-directional interface. This exchange is not limited to data, but also enables all information technology (IT) users throughout Doppelmayr who are involved with sales, production, configuration or maintenance of the custom installation of the group’s systems to utilize a number of actions typically performed by users of NX. This uncommonly close co-operation of people across departments and locations is paramount for Doppelmayr’s sustained success in the global market. “With more than three million different active items in the ERP system, data integrity is of the essence,” remarks Czerwinski. “Straightforward installations of all software products, including NX and Teamcenter, are essential to advancing our ability to innovate.” Using these tools, Doppelmayr created in just five years the successor of its most successful system, one that had become what it was by continuous improvement over more than four decades. “I am not sure we would have achieved our design goals using any other software,” concludes Czerwinski.

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