

SIEMENS

Ingenuity for life

Automotive and transportation

Doppelmayr

In just five years, mobility systems provider creates successor of a complex system portfolio developed over decades

Products

NX, Teamcenter

Business challenges

Globally distributed development locations

Very large assemblies

Entirely new generation of gondola/chairlift system to develop

Unmovable deadlines (start of winter season)

Keys to success

Use NX software for design and performance verification

Use powerful custom ERP software interface

Use Teamcenter software for international collaboration

Perform all tests digitally

Results

Developed a new generation, continuous-movement monocable gondola/chair lift system product line in comparatively short time

Increased speed and size of transport vessels resulting in higher transport capacity while reducing station size

Reduced noise and vibration while improving serviceability

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 funiculars 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.

Results *(continued)*

Achieved successful operation immediately upon initial installation

Maintained manageability of millions of designs over prolonged periods

“Creating this new premium product line was a joint effort of design engineers in various locations in Austria, Switzerland, Italy, Canada and the United States who utilized NX and Teamcenter more extensively than ever before.”

Dirk Czerwinski
Technology Process
Coordinator
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.

“Our engineers have implemented more than 200 innovations, 31 of which are brand-new significant design features.”

Christoph Hinteregger
Technical Director
Doppelmayr

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 monicable 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.

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. 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

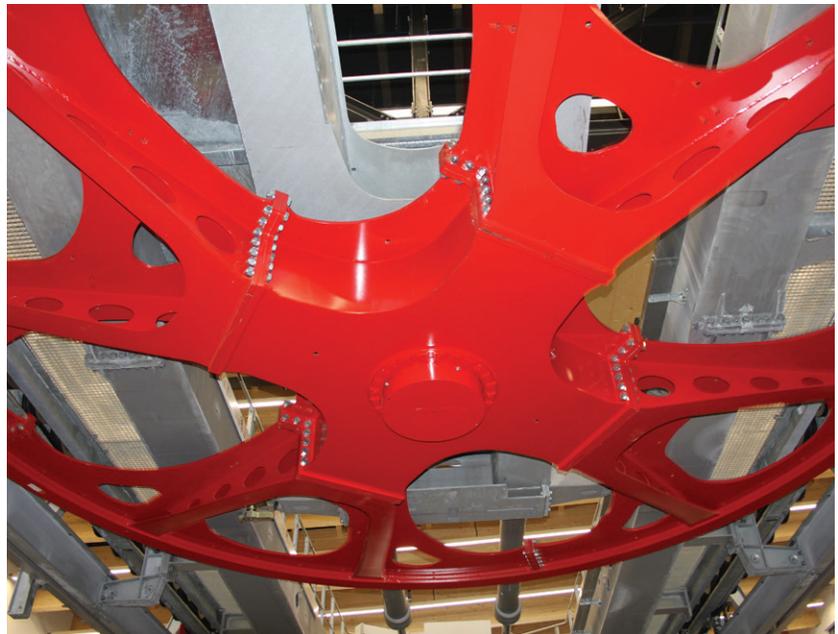
"Creating this new premium product line was a joint effort of design engineers across various locations in Austria, Switzerland, Italy, Canada and the United States," says Dirk Czerwinski, former design engineer and now technology process coordinator at Doppelmayr. "They utilized NX and Teamcenter software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

"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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Coordinator
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"Using NX within a Teamcenter environment ensures a common knowledge base and unerring workflows."

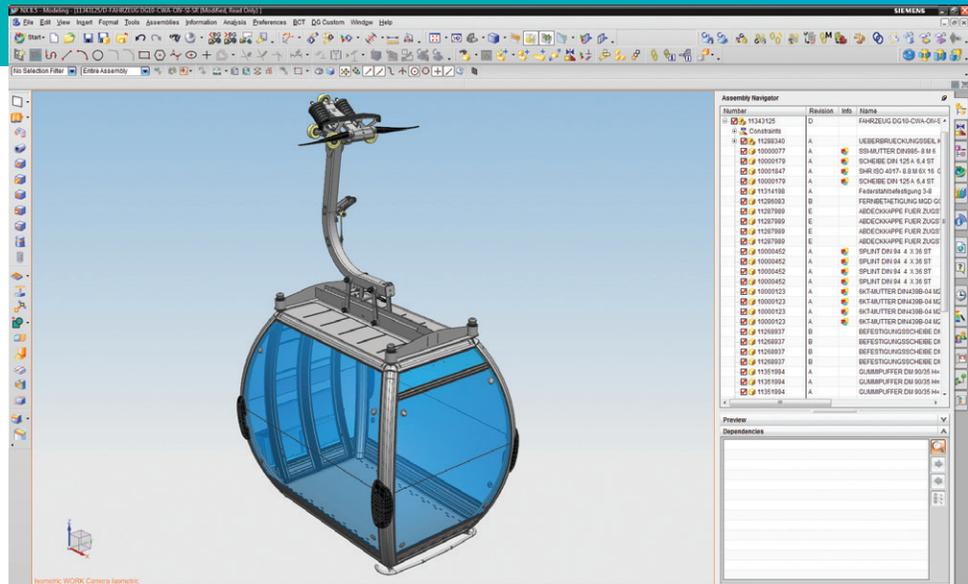
Dirk Czerwinski
Technology Process Coordinator
Doppelmayr



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.

“The sheer size and complexity of systems such as a detachable gondola or chair lift prevents prototyping in the real world. Using NX allows our engineers to remove every obstacle to smooth and safe operations in the safe environment of the virtual world.”

Dirk Czerwinski
Technology Process
Coordinator
Doppelmayr



All Doppelmayr equipment is modeled and maintained throughout its lifecycle using NX in a Teamcenter environment, including gondola cabin designs created using third-party CAD software by Doppelmayr group member CWA.

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.”

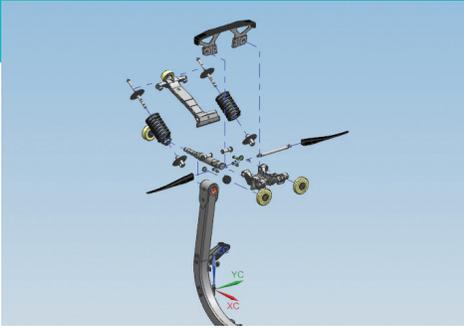
Doppelmayr engineers find synchronous technology especially fast and productive when importing computer-aided design (CAD) data created using other software. “This can be relevant when architectural models are part of the overall system design,” Czerwinski explains. “Likewise, we import models of the 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

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Technology Process Coordinator
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NX is used to model not only central components such as the cable clamp but also all standard parts. This allows creating system models in various levels of detail and keeps the more than three million different active items manageable using a bi-directional interface between NX and the ERP system.

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.

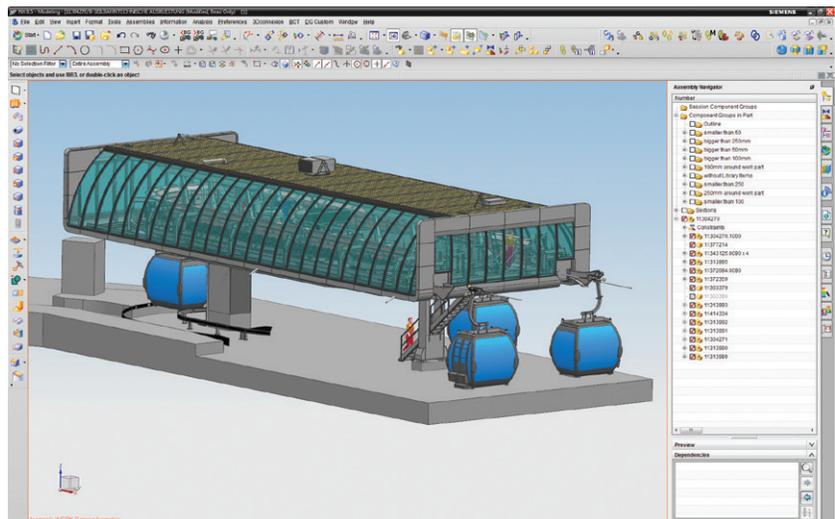
"We are using the standard functionality of NX and Teamcenter without any modifications," says Czerwinski. "This helps us to keep standard procedures in use at all times." It also helps minimize the efforts required for updating to newer versions of

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.

"We find it very helpful to be able to verify the equipment's usability using the human modeling functionality within NX."

Dirk Czerwinski
Technology Process
Coordinator
Doppelmayr



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.

Solutions/Services

NX

www.siemens.com/NX

Teamcenter

www.siemens.com/teamcenter

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

Wolfsfurt
Austria

"Straightforward installations of all software products including NX and Teamcenter are essential to keep up our engineering's ability to innovate."

Dirk Czerwinski
Technology Process
Coordinator
Doppelmayr

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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Dirk Czerwinski
Technology Process Coordinator
Doppelmayr

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