SIEMENS

Mobility Division

Background Information

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Advanced technology for reliability, safety and improved mobility along North America's rail routes

North America is rediscovering the railroad as an environmentally friendly and reliable means of travel. In many large U.S. cities and Canada, light rail and streetcar networks are being expanded. And along mainline passenger and freight rail systems, routes and fleets are being modernized with new generations of energy-efficient, low-emission vehicles, and the first projects for high-speed rail lines are being planned.

Siemens Mobility Division has been a leading partner and technology provider for rail operators for decades. The U.S. is a home market for the company's rail business: Trains are built in America, for America. The company's plant in Sacramento, California, is one of the most modern and important facilities of the Mobility Division worldwide.

Highway traffic jams, heavily congested cities and a crowded airspace near capacity are all making rail travel an attractive mode of transportation in North America. In the U.S., railway systems between the Atlantic and Pacific have a national network of some 225,000 kilometers, roughly seven times as long as the rail network in Germany. Canada's rail network covers an additional 50,000 kilometers. Although these rail routes are primarily used for freight transport, experts in the meantime see a renaissance for modern passenger rail transport. "More and more Americans are leaving their cars at home and deciding in favor of more comfortable and convenient trips with trains, subways, light rail and streetcars. We are proud of our innovations for passengers and commuters," says Michael Cahill, head of Siemens' rail vehicle business in the U.S. since 2011, looking at the country's changing market.

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The Sacramento plant: Rail rolling stock

The heart of Siemens rail systems is the company's manufacturing facility for rolling stock in Sacramento, California. The plant opened more than 30 years ago and currently has around 1,000 employees. Internationally, it is one of the most highly qualified suppliers of rolling stock and train systems, ranging from streetcars and light rail trainsets to locomotives and coaches. Offering everything from development, design and engineering, the manufacturing of components, and the turnkey delivery and maintenance of vehicles, the location provides a complete program for the production of modern rolling stock. To keep pace with growing demands on products and advances in technology over the years, Siemens has invested around USD100 million over the past ten years and has created skilled jobs in the region. Some of these employees have been trained in partnership with the local labor office to gain the welding skills required to manufacture vehicle body shells. The location is considered to be a model for modern, environmentally-friendly industrial production, and has long generated a share of its electricity with solar energy.

For its rail systems business, Siemens Mobility Division operates three other U.S. locations in addition to Sacramento, and has built up a network of around 200 specially qualified suppliers in the U.S. over the years. As a result, companies in 90 cities located in 30 states across the country participate in its supply chain. The facility has an impact on employment well beyond its own workforce in the region around Sacramento: Around 130 supplier firms are settled in a radius of 100 miles. Not least because of the close interdependence on these partners, Siemens' U.S. rail systems business adheres to the strict rules of "Buy America" required for state investments.

From streetcars to light rail

Beginning in the 1970s, a number of major cities in North America began to explore new mobility solutions with rail. Many cities already had a tradition of streetcars that reached all the way back to horse-drawn cars in the pre-automobile era. Instead of restoring the old streetcar lines, the cities developed modern light rail systems. For more than three decades, Siemens has been contributing its innovative light rail know-how in the U.S. and Canada and delivering vehicles, electrification systems and operating systems for local light rail projects.

Among the first light rail customers was the Canadian city of Calgary, where the transport agency Calgary Transit has been operating public transport systems since 1909. The backbone of the agency's offering since 1981 has been the light rail system with technology provided by Siemens. Serving over 300,000 passengers daily and with a network of nearly 60 kilometers in length, the system is the largest in North America and the second largest worldwide. For over 30 years, Siemens type U2 vehicles have been operated in Canada's fourth largest city, located on the eastern slopes of the Rocky Mountains. Taking place now and through the end of 2017, the U2 vehicles will be replaced with 63 type S200 light rail vehicles.

Calgary: Joint planning with a trusted partner

Following an international tender, Calgary Transit decided to continue its partnership with Siemens. Over the decades of close cooperation between manufacturer and operator, a relationship of mutual trust had developed. The relationship covered everything from the delivery of the vehicles to daily processes in operations and in the shops. This close collaboration also played a decisive role in determining the requirements for the next generation of vehicles, from questions of energy efficiency and environmental compatibility in operation to cost-effective maintenance concepts. "The purchase of new rail vehicles is a very long-term business. We need close ties to our suppliers and the good advice of their people for at least 15 years," explained Russell Davies, Transit Fleet Manager for the City of Calgary. "In its long partnership, Siemens has always been able to combine advances in the development of rail technology with the specific needs of Calgary Transit," said Robert Hardt, President and CEO of Siemens Canada. He added: "In the 30 years of our partnership, we have thus understood how to adapt the vehicles especially to the needs of this modern and growing major city. And now our job is to secure efficient and sustainable mobility for the next generation of citizens for the 21st century."

For three Canadian cities and San Diego in Southern California were the next cities to turn to rail for their public transport systems. Today, modern, comfortable and efficient light rail lines provide fast and reliable service in 40 cities in North America, usually on their own rail lines separate from road traffic. So far, Siemens has delivered over 1,300 vehicles from its plant in Sacramento and is market leader in the U.S. and Canada. Every third light rail vehicle was produced in the California plant.

Biggest light rail order from San Francisco

This business is continuing to grow in impressive dimensions. The company currently has a backlog of orders for around 400 additional light rail vehicles. These vehicles will be used in San Diego, Calgary, Seattle, Denver and San Francisco and in the “Twin Cities” of Minneapolis-St. Paul. Of these orders, the one received from the San Francisco Municipal Transportation Agency (SFMTA) for 215 units is the biggest light rail order received to date by Siemens in the U.S. SMFTA is replacing its over 20-year-old vehicle fleet and expanding in order to meet growing demand on its six lines that serve hundreds of thousands of passengers a day. The new generation of vehicles is distinguished by high energy efficiency, including the recuperation of braking energy for the power system. They are easily maintained, offer modern comfort and convenience, and ensure extensive recycling at the end of their lifecycle. Digital diagnostics systems will ensure the fleet’s consistent and high availability.

In the American mass transit rail market, concepts for electric operation without overhead lines is gaining favor in many plans for expanding rail networks. For this purpose, Siemens has converted its type S70 light rail vehicle, that is used widely in the U.S. and largely corresponds to a European streetcar, into a hybrid vehicle. The vehicle’s power comes either from the pantograph and overhead power line or from batteries within the vehicle. Powerful batteries and a high-tech charging technology that recharges the batteries when the vehicle is operating with an overhead line as well as a system for recuperating braking energy make it possible to operate the vehicle without problems on stretches without a power line. In San Diego, a tested Siemens battery-powered streetcar set a world record by travelling 24 hours on a single charge, thus earning an entry in the Guinness Book of Records. In the U.S. market, the city of Charlotte in North Carolina was the first to order the hybrid model. The transport company wants to use the new vehicles to operate on a four-kilometer extension of the usual route without having to install the complex overhead power line infrastructure.

High-performance charging system for electric buses

Innovations in energy storage technology have also led to cooperation with the Canadian bus manufacturer Nova Bus, a subsidiary of the Volvo Group, to develop a powerful electric bus for North American transport companies. As part of Montréal's "City Mobility" project, Siemens is supplying two quick-charging stations

for the Monk bus route. These will provide energy to three fully electric buses from Nova. The new vehicle, based on a frequently used bus platform, has a powerful battery system that can be charged in less than six minutes from a roof pantograph at the terminals of the bus line. In addition to offering the advantages of pollution-free and quiet operation in cities, the electric drive technology also leads to energy savings of up to 80 percent over conventional diesel buses.

New U.S. locomotives from the European modular system

Among the more recent business fields for the Mobility Division in America is the development and delivery of vehicles for the so-called “heavy rail” or mainline rail sector. For intercity transportation along the 700-kilometer Northeast Corridor from Washington D.C. to Boston, Siemens delivered 70 electric locomotives for Amtrak, the state-owned U.S. railway company. They are part of a comprehensive renewable program for the Amtrak fleet and replace locomotives that have been in service for 20 to 30 years. The “Amtrak Cities Sprinter” is based on the Eurosprinter and Vectron locomotives developed in Europe by Siemens. The Sprinter is produced in the Sacramento plant that was expressly expanded to handle this major order. Despite its European roots, this locomotive is also an American product through and through, with components from various Siemens plants in the states as well as from more than 60 suppliers throughout the U.S.

The Amtrak Cities Sprinter type ACS-64 locomotives are equipped for the three standard overhead line voltages in North America, 25 kV, 12.5 kV and 12 kV, and have an output of up to 6.4 MW. As in the new generation of light rail vehicles, braking energy is recuperated and fed into the overhead power line to increase the locomotive’s efficiency. The locomotive’s technical design with its simple and easily accessible arrangement of components also makes maintenance fast and cost-efficient. On some sections of the Northeast Corridor (NEC), the Amtrak Cities Sprinter reaches a top speed of 200 km/h with up to 18 coaches.

A further development based on modern European locomotive technology is the diesel-electric “Charger” locomotive that can also be used for passenger trains. It was designed at the Sacramento plant to serve on the many non-electrified rail lines in the U.S. network. Like its sister Amtrak Cities Sprinter, the Charger is Buy America compliant. The first order for the locomotive was for Brightline, the privately funded passenger rail system that will connect Orlando and Miami, Florida. The Chargers were also ordered by the rail authorities Illinois Department of Transportation

(IDOT), the California Department of Transportation (Caltrans) and the Washington Department of Transportation (WSDOT) with an initial 35 units for service in their respective states. Further orders followed, and 81 locomotives are now in the order books.

The locomotives with only one driver cab – unlike the usual configuration for Europe – are equipped with a 16-cylinder diesel engine that generates electricity for the traction current. The state-of-the-art, electronically controlled drive system fulfills the stringent “Tier 4” emissions standard in the U.S. This means that the new locomotive reduces climate-damaging emissions by 90 percent compared to “Tier 0” conventional diesel units. As measured by the train’s passenger capacity, the consumption of diesel fuel is one-third the energy requirements of an automobile carrying two persons. With a top speed of 125 miles per hour, or ca. 200 km/h, the Charger offers attractive perspectives for the renewal and modernization of the U.S. rail network. The prototypes were intensively tested in the Transportation Technology Center (TTC) operated by the U.S. Department of Transportation in Pueblo, Colorado. “These diesel-electric locomotives represent the next generation of environmentally friendly and efficient rail operations in the United States. The tests here in Pueblo mark a major step toward providing sophisticated and advanced rail technology everywhere in our country,” explains Cahill.

Brightline: Traveling comfortably with diesel-electric through Florida

The first Brightline train, comprised of a Charger locomotive and four coaches, arrived in its future area of operation in Florida early this January – after traveling some 3,000 miles from its official hand-over at the Sacramento plant to West Palm Beach on Florida’s Atlantic coast. The new train is part of the Brightline project run by a real estate and logistics group headquartered in Miami planning to develop attractive and fast rail transport in Florida. The company has ordered five trainsets, each consisting of a Charger locomotive at each end and four comfortable passenger coaches. These 20 coaches are the first to be designed and produced in the California plant according to the specific concept of the customer. Brightline plans to inaugurate service between Miami, Fort Lauderdale and West Palm Beach in the summer of 2017. Travel time on the restored rail line between the newly built, modern railroad stations should take one hour for the roughly 100-kilometer stretch – considerably less than by car on the heavily congested highway. There are plans to extend the Brightline service to Orlando in central Florida, which would require

further upgrade and expansion of the rail line. The new trains should be able to travel at “high speed” on at least part of the stretch: according to American definition, this means 200 km/h.

High-speed with the Velaro for the U.S.

Over the years, there have frequently been considerations in North America to build new rail lines for high-speed trains with a top speed of 350 km/h. The furthest advanced of these plans have been for the Northeast Corridor Washington D.C. – New York – Boston, and in California between San Francisco and Los Angeles, with supplementary links to San Diego in the south and Sacramento in the north. In California, the idea is to provide eight-car trainsets for 400 to 450 passengers that reach a top speed of 220 miles an hour.

Siemens can offer its eight-car Velaro for high-speed projects like in California: the train has been operating successfully as a proven high-speed trainset for years in Germany as the ICE 3 Series 407 as well as in France, Spain, Russia and China. The train’s concept allows a number of variants and modifications for meeting different technical conditions, train configurations, equipment wishes or even operation in extreme winter or summer temperatures.

Trains for California or similar projects would be completely manufactured in Sacramento. Along with the existing plant in Sacramento, Siemens has an adjoining lot that is already planned for a facility to build coaches for Velaro trains. For the Velaro production, Siemens would organize a comprehensive transfer of know-how between the Mobility factory in Krefeld, Germany and the plant in California. Mobility’s plant in Krefeld has around 2,200 employees specialized in the manufacture of high-speed trains and completes up to 450 coaches a year.

Rail Automation technology for safe, intelligent train operation

Siemens is working with the New York City Metropolitan Transit Authority to install Communications-Based Train Control (CBTC) on subway lines across NYC. The radio-based CBTC technology provides real-time data on vehicle position and speed conditions, allowing system operators to safely increase the number of vehicles on a rail line. This results in greater frequency of train arrivals and allows MTA to accommodate more passengers on its system. Rail Automation also provides critical safety technology systems called Positive Train Control (PTC), a technology solution that helps monitor and control train movement, for customers across the U.S.

including Amtrak along the Northeast Corridor and the Southeastern Pennsylvania Transportation Authority (SEPTA).

Siemens also recently introduced RailFusion, a powerful software solution that monitors and analyzes data points across an entire railroad's infrastructure including onboard and wayside assets like road crossings and end-of-train devices. The software can provide operators unprecedented insight into activity across an entire railway by remotely monitoring and capturing data from both Siemens and third-party devices located on the infrastructure. By inserting intelligence behind the captured data, the software can evolve to include predictive capabilities that will help railroads identify trends to better plan their operations and fix issues before they become a problem, resulting in greater time and cost savings.

This press release and additional information on Siemens' exhibits at the UITP 2017 are available at: www.siemens.com/press/uitp2017

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Siemens AG (Berlin and Munich) is a global technology powerhouse that has stood for engineering excellence, innovation, quality, reliability and internationality for more than 165 years. The company is active in more than 200 countries, focusing on the areas of electrification, automation and digitalization. One of the world's largest producers of energy-efficient, resource-saving technologies, Siemens is a leading supplier of efficient power generation and power transmission solutions and a pioneer in infrastructure solutions as well as automation, drive and software solutions for industry. The company is also a leading provider of medical imaging equipment – such as computed tomography and magnetic resonance imaging systems – and a leader in laboratory diagnostics as well as clinical IT. In fiscal 2016, which ended on September 30, 2016, Siemens generated revenue of €79.6 billion and net income of €5.6 billion. At the end of September 2016, the company had around 351,000 employees worldwide. Further information is available on the Internet at www.siemens.com.