

## In California's high-speed train efforts, worldwide manufacturers jockey for position

By Tim  
Sheehan



In this photo from South Korea's Hyundai Rotem, a KTXII Sancheon train built for KORAIL, the national rail system. The KTX line of trains, in service since 2004, has a top operating speed of 186 mph. The company's next-generation HEMU-430X train, under development, is being designed for a maximum speed of 267 mph. HYUNDAI ROTEM

- Potential California HSR train manufacturers

**Companies that answered California's initial request for expressions of interest in building a fleet of electric trains for the state's proposed high-speed rail system hail from around the world:**

<b>Company</b>	<b>Headquarters country</b>	<b>Countries with its HSR* equipment</b>
Alstom Transportation Inc.	France	France, Belgium, United Kingdom, Germany, Netherlands, Spain, Switzerland, Italy, South Korea, China, Morocco (planned)
AnsaldoBreda S.p.A.	Italy	Italy
Bombardier Transit Corp.	Canada	Germany, Italy, Spain, Netherlands, China (planned)
CSR Corp. Ltd.	China	China
Hyundai Rotem Co.	South Korea	South Korea
Marnell Transportation	Las Vegas	none
Kawasaki Rail Car Inc.	Japan	Japan, China, Taiwan
Siemens Industry Inc.	Germany	Germany, Netherlands, Spain, France, Belgium, United Kingdom, China
SunGroup USA / CNR Tangshan	China	China
Talgo Inc.	Spain	Spain, Saudi Arabia (planned)

\* Countries in which the manufacturer has supplied trains with operating speeds of 186 mph or faster

Source: UIC ( *Union Internationale des Chemins de fer*, or International Union of Railways)

Across Europe and Asia, more than 1,300 trains routinely carry passengers at speeds of 186 mph or faster, and about 400 more are on order.

But none of those trains run on tracks anywhere in the United States, and none of them are being built here, either. Around the world, the high-speed rail industry is dominated by corporate players in Germany, France, Spain, Italy, China, Japan, South Korea and Canada.

So next spring, when the California High-Speed Rail Authority hopes to start the long process of buying rolling stock for its statewide rail system, it might just touch off a bidding frenzy as firms jockey for a contract to build dozens of the sleek, all-electric vehicles. An initial order could be 15 to 20 trains, and the contract could potentially call for as many as 95 trains over the next decade. A hint of the enthusiasm surfaced in late October, when nine manufacturers responded to the rail agency's request for expressions of interest in building its trains and initial specifications.

Those companies include France's Alstom; Italy's AnsaldoBreda; Canada's Bombardier; China's CSR Corporation Ltd. and SunGroup/CNR Tangshan; South Korea's Hyundai Rotem; Japan's Kawasaki; Germany's Siemens; and Spain's Talgo. They — and perhaps others — have their eyes on a lucrative prize.

In its 2014 business plan, the rail authority estimated that it will need to spend \$889 million to buy the vehicles it requires for its “initial operating segment” from Merced to Burbank, now planned to start carrying passengers by 2022. By 2028, when the entire Phase 1 of the statewide system is expected to be built out from downtown San Francisco to downtown Los Angeles and Anaheim, capital spending for vehicles is anticipated to balloon to about \$3.3 billion (in 2013 dollars unadjusted for inflation).

The trains are expected to have a service life of 30 years before they need to be replaced.

Federal law requires that the trains and all of their components be American-made. That means that the company that ultimately wins the contract must establish a manufacturing plant in the U.S., as well as an American parts-supply chain. California also has its own “Buy California” legislation on the books requiring the state rail authority to “make every effort to purchase high-speed train rolling stock and related equipment that are manufactured in California.”

Who’s already here?

The Federal Railroad Administration recently granted the California High-Speed Rail Authority a waiver of the federal “Buy America” requirements, allowing up to two prototype trains to be foreign-built — a move that will allow time for the winning bidder to set up a U.S. production plant. “FRA estimates that it could take HSR train set manufacturers a minimum of one and a half to two years to establish the required facilities to support a domestic HSR train set assembly capacity,” the federal agency wrote in its Nov. 24 waiver notification letter.

The waiver also applies to foreign companies that already have U.S. plants making conventional rail equipment. “In addition to acquiring specialized machinery and training and hiring the workforce, these manufacturers’ plants are customized for steel railcars, and HSR train sets require aluminum, which requires different manufacturing techniques.”

Who’s already here? Alstom, Bombardier and Kawasaki all have manufacturing plants that are building components for conventional rail systems. Kawasaki also has a rail-car plant in Nebraska. Talgo opened a shop in Wisconsin, where it built a pair of diesel trains now being used on Amtrak’s Cascades route in the Pacific Northwest. Hyundai Rotem builds commuter rail cars at a plant in Pennsylvania.

Siemens has a plant in Sacramento to build trolleys and light-rail commuter trains as well as electric locomotives for two of Amtrak’s East Coast passenger routes, and plants in Georgia and Ohio for propulsion equipment and motors.

The prospects for high-speed rail in California and the U.S. is indicative of a growing demand for newer and faster train sets worldwide, according to Ignacio Barron de Angioti, director of passenger rail for the *Union Internationale des Chemins de fer* (UIC, or International Union of Railways).

“The expected development of high speed railways at the global level in the coming years is extremely spectacular,” Barron de Angioti said in a UIC statement. He predicted that the mileage of dedicated high-speed line expected to be built between 2007 and 2022 would be four times as much as had been completed since the first bullet trains began operating in Japan in 1964.

He added that more than 5,000 train sets capable of operating at speeds above 125 mph are expected to be in operation by 2027, compared with about 2,900 at the end of 2013.

What’s on the shelf?

California initially wanted to join with Amtrak in soliciting bids for new high-speed train sets — California with its eye on 220-mph trains for the dedicated high-speed-only tracks it plans to build between San Jose and Los Angeles, Amtrak looking for slower 150-mph trains for its Acela Express service in the Northeast. The two agencies issued a joint request for bids in January, but canceled the process a few months later after manufacturers said California’s and Amtrak’s respective needs were too different to meet with one type of train.

Frank Vacca, the state rail authority's chief program manager, said then that separating California's bidding process allows the state to seek trains based on what's already in service around the world, rather than forcing manufacturers to try to hybridize equipment.

"Now we're going to have something much closer to off-the-shelf train sets from manufacturers," Vacca said. "There will be fewer modifications needed to the designs out there today that are operating at 220 mph. The more we can keep it off-the-shelf, the better it is for cost."

California wants electric train technology that's been proven with at least five years of commercial service at operating speeds of at least 186 mph. It wants trains that can carry passengers at 220 mph to ultimately make a nonstop trip from San Francisco to Los Angeles in 2 hours 40 minutes. It wants train sets — a single unit of several passenger coaches with control/power cars at each end — with at least 450 seats and up to 672 feet long, or longer than two football fields.

Those broad specifications cover much of what manufacturers have built for years for Europe and Asia, as well as newer trains that firms hope can take hold in the global marketplace:

- Alstom made some of the oldest 186-mph-plus trains now operating in the world, based on its TGV ( *Train à Grande Vitesse*). France's TGV Atlantique line has trains dating from 1989, while Spain's first AVE ( *Alta Velocidad*) high-speed rail line between Madrid and Seville opened in 1992 with Alstom train sets. Morocco has ordered 14 200-mph TGV trains for its high-speed program. In recent years, Alstom introduced its next-generation AGV ( *Automotrice à Grande Vitesse*) trains with a maximum speed of 223 mph.
- Kawasaki is among several Japanese firms that have collaborated to build Japan's Shinkansen fleet over the last 50 years. At international rail conferences, Kawasaki has stated that it plans to pitch its latest bullet-train incarnation, the 220-mph efSET (Environmentally Friendly Super Efficient Transport) for American high-speed lines.
- Siemens has incarnations of high-speed trains in service in Europe and Asia; its ICE-3/Velaro trains run throughout Germany and other European lines, including Spain's Madrid-Barcelona route, at speeds up to 220 mph. Representatives at Siemens' Sacramento manufacturing plant said the company anticipates pitching its Velaro trains for California.
- Talgo, the Spanish manufacturer, joined forces with Canada's Bombardier to build sets of Talgo 350 trains nicknamed " *el Pato*" ("the Duck") because their elongated front end resembles a duck's bill. Those trains, designed to run at 220 mph, are used on Spanish lines including the Madrid-Valencia route, and 36 have been ordered by Saudi Arabia. Talgo's next-generation train, the Talgo AVRIL, is designed to run at operating speeds up to 236 mph.
- In Italy, AnsaldoBreda and Bombardier have joined to design and manufacture a new line of trains intended to operate at speeds up to 220 mph. AnsaldoBreda has dubbed the train the Frecciarossa 1000, while Bombardier markets it as V300 Zefiro Italy. AnsaldoBreda collaborated with Bombardier and Alstom on an earlier generation of 186 mph trains, the ETR500 that began entering service in 1993.
- Bombardier has also sold 70 units of an even faster train, the Zefiro 380, with a top operating speed of 236 mph, to China.
- Hyundai Rotem has several variations of its KTX 205-mph electric trains in service with Korail, South Korea's national rail operator. Hyundai Rotem recently completed a six-year program to develop its next-generation train, the HEMU-430X, a train with a designed maximum speed of 267 mph.
- China's CSR Corporation Ltd. is expected to pitch its CRH 380A, which entered service in 2010 and has a top speed of 236 mph. The trains have been the focus of a dispute in recent years, however, because Japan's Kawasaki has claimed that CSR poached its rail technology — a claim that China disputes. The CRH 380A bears a strong outward resemblance to trains built by Kawasaki.

- CNR-Tangshan, which is teaming up with SunGroup USA, is likely to market a version of its CRH 380BL trains for the California project. The CRH 380BL, which entered service in 2011, has a top speed of 236 mph. It closely resembles the Velaro high-speed trains built by Siemens, which collaborated with CNR on an earlier generation of train sets for China's high-speed rail lines.

The two Chinese manufacturers, CNR and CSR, have applied to the Chinese government for approval to merge, according to published reports — potentially providing a combined company to have greater leverage to seek international rail contracts.

Time is money

The cost of the rolling stock is included in the California High-Speed Rail Authority's overall capital cost estimate of about \$68 billion (adjusted for inflation through 2028) to design and build Phase 1 of the rail system from San Francisco to Los Angeles.

The agency's 2014 forecast of \$889 million to buy trains for its Merced-Burbank operating segment works out to about \$44.5 million per train set for a 20-train order. The exact cost, however, won't be known until manufacturers make their formal bids. A 2011 report by consultants to the U.S. Office of the Inspector General indicated that the price of train sets running on European lines ranged between \$30 million and \$70 million each.

The expectation for California trains to be based on builders' established products not only fuels the rail authority's hope for lower prices, but could also shorten the time for a train to get from the drawing board onto the tracks. Armin Kick, Siemens' director of high-speed rail development, told The Bee last year that it could take three years or longer for a company to draw up a new design for a train. But, he added, adapting an existing design could slice the schedule — about two years from the time a customer places an order to the delivery of the first train.

Lisa Alley, a spokeswoman for the state rail agency, said the authority anticipates issuing its request for bids sometime this spring and will likely hold one-on-one meetings with would-be manufacturers during the bidding period to answer questions about specifications. The state has offered no firm schedule on how quickly it expects to evaluate bids, award a contract or place its first orders.

In late 2013, as California and Amtrak planned a joint purchase, California's Vacca said that if orders were placed by mid- to late 2014, prototype trains might be delivered by late 2018. Now, depending on how soon the rail authority awards a contract, an order could be placed by early 2016 with delivery of prototypes two to three years later.

Contact Tim Sheehan: [tsheehan@fresnobee.com](mailto:tsheehan@fresnobee.com), (559) 441-6319 or [@TimSheehanNews](https://twitter.com/TimSheehanNews) on Twitter.

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