



Business Area  
Elevator Technology

Backgrounder

November 27, 2014

## **MULTI achieves the Elevator Industry's Holy Grail: Enables the operation of multiple cars in a single elevator shaft, combined with horizontal shaft-changing cabin systems**

*The era of the rope-dependent elevator is now over, 160 years after its invention. Buildings can now evolve, reach new heights, shapes and purposes. The application of linear motor technology from the Transrapid magnetic train to vertical transportation maximizes shaft efficiency in mid to high-rise buildings, and provides immense benefits for developers and passengers alike.*

Although it is the current norm in the elevator industry, the fact that most elevators only move in vertical shafts, with one elevator per shaft, is becoming a limitation for the building industry as the capacity of moving people is constricted and elevators occupy excessive floor space in buildings.

After a first attempt to address this issue in 2003 with the TWIN elevator system, offering two cabins per shaft and increasing transport capacity by 30% as well as a reduction in the elevator footprint in buildings by 30%, ThyssenKrupp is now removing the suspension ropes and equipping elevator cabins with linear motors, transforming elevator systems in vertical mass transit systems – shaft transport capacities will increase by 50% and elevator footprints in buildings can be reduced by up to 50%.

Considered by many as the Holy Grail of the elevator industry, ThyssenKrupp MULTI applies the linear motor technology developed for the magnetic levitation train Transrapid to elevator cabins, enabling

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them to move in shafts in the same way that trains move in rail systems, with various cabins per shaft, and permitting vertical as well as horizontal movements inside buildings. Safety is ensured by the multi propulsion and braking systems in cabins and by the well-proven safety control system developed by ThyssenKrupp for the TWIN elevator technology that prevents cabins from getting too close to each other inside the shafts.

**Urban Settlements**

While more than half the world's population already lives in urban areas, there is expected to be a 2.5 billion increase in urban population numbers by 2050. With severe restrictions on space, mid to high-rise developments have proved to be the most economically and environmentally viable developments to accommodate these rapidly growing urban populations; in addition to occupying less soil, essential to secure green areas for the city, they also allow for centralized intelligent control of energy.

Besides the number of tall buildings increasing, their average height is also surpassing past expectations. In 2000, the average height of the world's 50 tallest buildings was 315 metres, while in 2013, that same average reached 390 metres; a 25% increase in just one decade.

However, while the means to build taller buildings exists, without the ability to efficiently move the inhabitants of buildings between floors the functionality of skyscrapers is limited, translating into loss of revenues if residential and commercial spaces on the top-most floors cannot be sold.

Against this backdrop, it is clear that efficient mobility in buildings is no longer a luxury, but an absolute necessity, making MULTI one of the most significant innovations in the elevator industry, and in providing efficient mobility in cities - the beginning of a new era for the elevator industry.

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**Necessary Innovations**

A project on elevator travel done by students of Columbia University found that in 2010, New York City office workers spent a cumulative amount of 16.6 years waiting for elevators, and 5.9 years in the elevators, indicating that it is vital to increase the availability and efficiency of elevators.

A 2013 paper on the analysis of two-dimensional elevator traffic systems also likens the prevailing use of one cabin per elevator shaft to using an entire railway line between two cities to operate a single train – a clear waste of resources.

Therefore, as the nature of building construction evolves, it is imperative for the elevator industry to adapt its technologies to meet current efficiency demands– from the prevalent one-dimensional vertical arrangement to a two-dimensional horizontal/vertical arrangement, with more than one cabin operating in each shaft.

In this regard, TWIN elevators are already an advancement from the single cabin system, improving capacities as well as operational efficiency. However, an increase in the number of cabins in this system is restricted by the use of complicated cable arrangements, and the system requires that one car must always be above the other. Safety concerns also prevented earlier advancements in the use of ropeless elevators. This is where linear drives gain a massive advantage, eliminating the use of ropes and enabling the use of more than one car in the same shaft.

**MULTI**

MULTI is ThyssenKrupp's latest offering in its extensive repertoire of elevator technologies, and represents a landmark revolution in the elevator industry. Realising the long-pursued dream of operating multiple cars in the same elevator shaft, the system will also include horizontal shaft-changing cabin systems.

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MULTI's research and development phase has reached the point of building the first model and prototype, and ThyssenKrupp's new test tower in Rottweil provides the perfect test and certification environment to get this ground-breaking product onto the market. The test tower will be completed at the end of 2016, and by this time, the company aims to have a running MULTI prototype.

**How It Works**

Operating on the basic premise of a circular system, such as a paternoster, MULTI will use rope-less linear technology to operate elevators, and a single loop can incorporate various cabins. With a targeted speed of 5 m/s, the system will enable near-constant access to an elevator cabin every 15 to 30 seconds, with a transfer stop every 50 metres. Passengers will enjoy reduced wait times, and the option of double entries on the ground floor improves ease of access in large buildings.

MULTI also offers much higher capacities and faster and more comfortable movement as compared with high-speed elevators, which are limited by the effects of pressure on the human body, with many people experiencing discomfort while travelling in elevators at speeds higher than 10 m/s.

Although the ideal building height for MULTI installations starts at 300 metres, this system is not constrained by a building's height. With no ropes, a multi-level brake system, and inductive power transfers from shaft to cabin, MULTI requires smaller shafts of a mere 6 sqm, while other technologies such the TWIN require about 9 sqm. This can signify significant cost savings for the building's developer. The overall increase in efficiency also translates into a reduced need for escalators and elevator shafts, thereby decreasing a building's elevator footprint by up to 50%, and providing further usable floor space and revenues to building owners.

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MULTI applies the concept of the TWIN's control system and safety features, but includes new elements such as new and lightweight carbon composite materials for cabins and doors, weighing a mere 50 kg instead of 300 kg in standard elevators, resulting in an overall 50% weight reduction as compared to standard technologies. A new linear drive also enables one single motor to be sufficient to perform horizontal and vertical movements, and an exchanger moves cabins from one shaft to the other.

By combining ground-breaking technology with a simple operation concept and convenience of passenger use, ThyssenKrupp's MULTI has transformed the idea of a flexible number of cars per shaft from a distant vision for the future into a reality.

*The Elevator Technology business area brings together the ThyssenKrupp Group's global activities in passenger transportation systems. With sales of 6.4 billion euros in fiscal 2013/2014 and customers in 150 countries, ThyssenKrupp Elevator is one of the world's leading elevator companies. With more than 50,000 highly skilled employees, the company offers innovative and energy-efficient products designed to meet customers' individual requirements. The portfolio includes passenger and freight elevators, escalators and moving walks, passenger boarding bridges, stair and platform lifts as well as tailored service solutions for all products. Over 900 locations around the world provide an extensive sales and service network to guarantee closeness to customers.*

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