

Transrapid Project Shanghai

Dipl. Ing. Dieter Hoffmann, Siemens AG

Abstract

Following brief negotiations initiated at the end of the year 2000, the contract for the supply of the airport link using the Transrapid Maglev system was signed in January 2001 by the Chinese Customer, the Shanghai Maglev Transportation Development Co. and the German Consortium formed by Transrapid International GmbH, ThyssenKrupp Transrapid GmbH and Siemens AG. The paper presents the project goals, the project process and challenges as well as the major scope of involvement of each participating party beginning with the signing of the contract up to commercial operation by the customer.

1 INTRODUCTION

The 30 km line between Pudong International Airport and Long Yang Road Station of Metro Line 2 was erected and commissioned by the German Consortium Transrapid International, ThyssenKrupp and Siemens in cooperation with the Shanghai Maglev Transportation Development Co. over a period of approximately three years. On December 31, 2002 the first three-section vehicle performed the VIP run with a maximum speed of up to 430km/h. The VIP run was attended by Chinese Premier Minister Zhu Ronghi and German Chancellor Gerhard Schröder as well as other high-ranking officials. Commercial operation began in January 2004. Today, the system operates in shuttle and circular mode with up to 3 five-section vehicles and 10 minutes headway according to transportation requirements.

Between January 2003 and the start of commercial operation more than 130,000 visitors have had the opportunity to travel on the train. By July 2004 more than 1 million passengers had traveled on the Transrapid and more than 1 million kilometers have been covered by the fleet.

Figure 1 shows the track details.



Figure 1

Project characteristics

Track length (double track):	30 km double track
Stations:	2
Vehicles:	3 trains with 5 sections each
Speed:	430 km/h
Trip time one way:	7.5 minutes
Minimum headway:	10 minutes
Daily operation:	18 hours

2 Contractual parties

The Customer is a group formed by the “End User” Shanghai Maglev Transrapid Development Co. (SMTDC) and “Party A” consisting of the three companies as
SIIC Shanghai International Trade (Group) Co. LTD,
Shanghai Pudong International Airport Import & Export Corporation and
Shanghai SITICO International Trading Co.
SMTDC was the contact partner responsible for project handling.

The Contractor group was formed by the Consortium Transrapid called “Party B” consisting of
Transrapid International GmbH % Co. KG (TRI),
Siemens AG (SAG) and
ThyssenKrupp Transrapid GmbH (TKT-TR).

The Consortium members SAG and TKT-TR were structured according to subprojects such as:
Operation Control System (OCS), Power and Propulsion System (PPP) and Additional Systems (ADS)
for Siemens AG. The three Siemens subprojects were managed by the Project Management Team of
which one subproject manager assumed the leading role for the SAG scope of supply.
In the same way ThyssenKrupp Transrapid GmbH was assigned the subprojects for the
Long Stator Winding (TKL), Vehicle (TKV) and Switches (TKS).

The scope of supply was divided between Customer and Contractor.

The customer SMTDC had to construct the infrastructure like Long Yang Lu station including the
operation control center, Pudong International Airport station, maintenance facilities and the concrete
guideway. Additionally the assembly work was the task of the customer.

The Contractor’s responsibility was the E&M scope of the system as well as the System Engineering
and Overall Project Management provided by TRI.

SAG was in charge of the Operation Control System (OCS), the Power Supply and the Propulsion
System (PPP) as well as the Power Rails and Information/Communication Systems (ADS).

Equipment like vehicles, switches, stator packs and the long stator windings were supplied by
TKT-TR.

The share of the Consortium was
7 % for Transrapid International
48 % for Siemens AG and
45 % for ThyssenKrupp Transrapid GmbH.

3 Milestones

With the Contract for Erection of the Airport Link Pudong International Airport to Long Yang Lu having been signed (Figure 2), the major goals of the project were defined on January 23, 2001. The system had to be ready for the VIP run (Figure 3), which was a major event attended by high-ranking politicians, within 23 months following the start of the project. In approximately 35 months the system had to be ready for commercial operation (Figure 4).



Figure 2; Contract signature
23.01.2001



Figure 3; VIP run
31.12.2002



Figure 4; Commercial operation
01.01.2004

After planning the infrastructure of the building, and finishing the construction work of the guideway beam construction hall, the Customer was able to start the construction of the guideway with the assistance of the German “Guideway Experts” in February 2001. Following the agreement of the Overall Time Schedule on May 18, 2001, the key milestones were broken down for each delivery of the Transrapid Consortium.

Figures 5 and 6 present the goals achieved during the project process.

Date	Event
January, 2001	Contract signature
April, 2001	Start of construction work
January, 2002	Start of installation OCS
March 2002	Start of installation PPP
May, 2002	Start commissioning OCS
May, 2002	Start commissioning PPP
August, 2002	First vehicle in Shanghai
November, 2002	Track B for VIP run available
December 31, 2002	VIP run with 430 km/h

Figure 5; From project start through to the VIP run

The Chinese customer started installation of the equipment under supervision of the contractor one year after signing of the contract.

In the next half year most of the equipment was assembled by the client and the consortium, including

- 2 substations plus the power supply 110/20 kV and the propulsion equipment
- 7 wayside transformer stations
- 60 wayside switch stations

- wayside feeder cable system
- approximately 125,000 stator packets
- approximately 950 km of long stator winding cable
- 23.8 km power rails including the power rail supply
- 8 switches including the switch stations
- operation control system
- and additional systems for communication and information

After only 16 months, commissioning of the power supply and control system hardware and software began.

The first vehicle arrived in Shanghai in August 2002 and Track B was fully available for operation after just 22 months.

The VIP run was a great success and took place on December 31, 2002. It demonstrated to the world that the Transrapid is a very high-performance system.

Date	Event
January/February, 2003	Demonstration runs
March, 2003	Runs with 5-section vehicle
May, 2003	Start rides track A 430 km/h
July, 2003	Vehicle meeting at max. op.
August, 2003	Finish commissioning
October, 2003	Start safety qualification
November, 2003	World record ride with 501 km/h
January 1, 2004	Start of commercial operation

Figure 6; From VIP run to start of commercial operation

After the VIP run it was necessary to let the public experience the performance of the system. For six weeks the people of Shanghai as well as foreign travellers were allowed to test the train during the demonstration run period. In March 2003 the first 5-section vehicle tests started and in May 2003 Track A was put into operation with a maximum operational speed of 430 km/h. Then two months later two vehicles passed each other in opposite directions at a maximum speed of 430 km/h.

By the end of August the commissioning had been completed and at the beginning of October 2003 the Safety Qualification process began. In November 2003 the configuration consisting of a two, five and eight-section vehicle was successfully tested and the Transrapid world record speed of 501 km/h was achieved.

The system has been in commercial operation since the beginning of 2004.

4 Goals, challenges and solutions

It is important to mention some of the goals and challenges. The Consortium had to face the fact that the system is the first commercial application of the Transrapid. It was also the first time the system had to be operated with more than one vehicle: in this case three. The expectations of the public and politicians of both countries involved were very high and therefore success was no option.

In addition to the above-mentioned challenges, technical issues like the very high humidity and very high temperature of the Shanghai area had to be considered. Incidentally, nearly 12,000 tons of freight had to be shipped by SAG from Germany to Shanghai. The first electrical components arrived in Shanghai in September 2001. Most of the equipment apart from the vehicles was delivered by October 2002. The last vehicle arrived in Shanghai in July 2003.

Added to the short time of 23 months up to the VIP run and 35 months up to the start of commercial operation, many challenges had to be overcome. The environmental conditions had to be checked so that they could be modified if necessary by means of air conditioning. The space available in the buildings had to correspond to the requirements of the equipment to be installed. The mechanical and electrical interfaces of every component had to be clarified.

The method of shipment, by airfreight or by ship, and the necessary time for shipment had to be taken into account. In addition it was necessary, by checking with the customer, to find the easiest way to get the equipment into China. The personnel requirement in Shanghai had to be planned as well.

Last but not least all special equipment had to be brought to Shanghai in good time. Customer staff had to be trained how to use the special tools in a proper manner. The process of supervision and assembly work procedures had to be agreed upon.

The complexity of the system is shown in Figure 7, which mainly shows the interfaces of the electrical subsystems delivered.

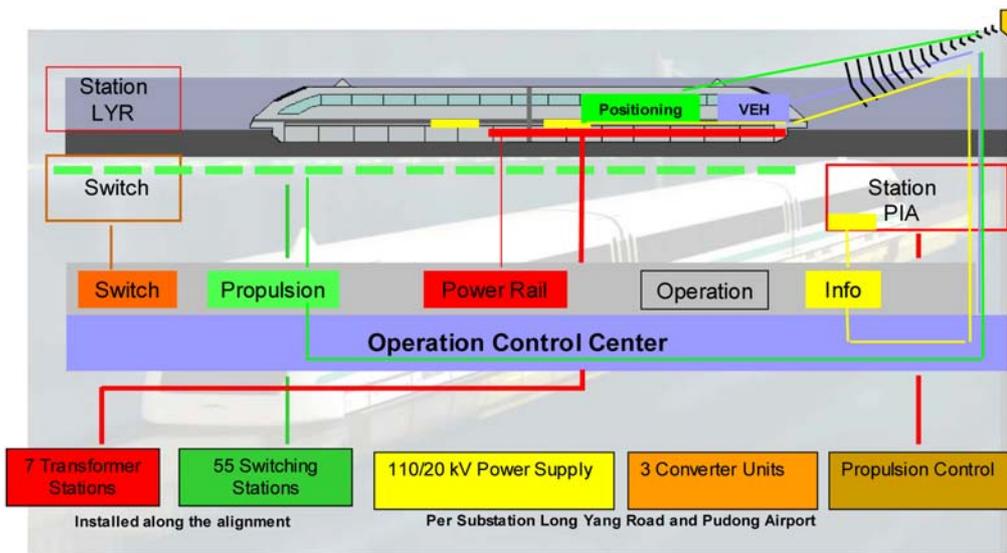


Figure 7, Interfaces of the subsystems

5 Cultural challenges

Not only technical or logistical issues need to be raised. Human issues are a major part of success especially in complex international projects. In order to agree on the design, many design liaison meetings were held and the customer's staff had to be trained for

- Operation of the system
- Maintenance of the system
- Rules & Regulations

An open cooperation is also a cultural challenge and needs a clear understanding of cultural differences. E.g. whereas Western people often do not mind when they get their meal it seems to be quite an important issue for Eastern people. It is important to be aware of such minor issues and respect them in order to create a pleasant and productive atmosphere for meetings.

It was also of great importance to know who is the right partner for communication in terms of decision makers, technical aspects, etc. Excellent preparation of documents and a good translation were essential for good understanding.

And what is valid worldwide also did count during the examination of this project. You have to set up agreed common project processes at an early stage and then, of course, you are expected to stick to them.

All training activities were carried out based on the principle “Train the Trainer”. This means nothing more than establishing the people first trained as multiplier for the next staff to be trained (avalanche effect). It is therefore essential to select the right people to act as multiplier at a later stage. Here again excellent documentation is a key to success. It must be appreciated that the methods of learning are different between the Western world and Eastern world. It had to be assumed that, whereas the Western people prefer to start with a look from top down, Eastern people often prefer to start learning bottom up. It is no secret to say that every trainer had to be able to understand the trainees’ needs.

6 Facts for success

As shown in Figure 8, the system is up and running today with a high stability. The system safety was demonstrated and proven between January and July 2004. By the end of July nearly 100% of the scheduled trips were without a delay of less than 5 minutes headway. This was compensated by the system over a normal day of operation. It can be seen that in July 2004 a total of 1 million kilometers were covered and more than 1 million passengers traveled with the Transrapid.

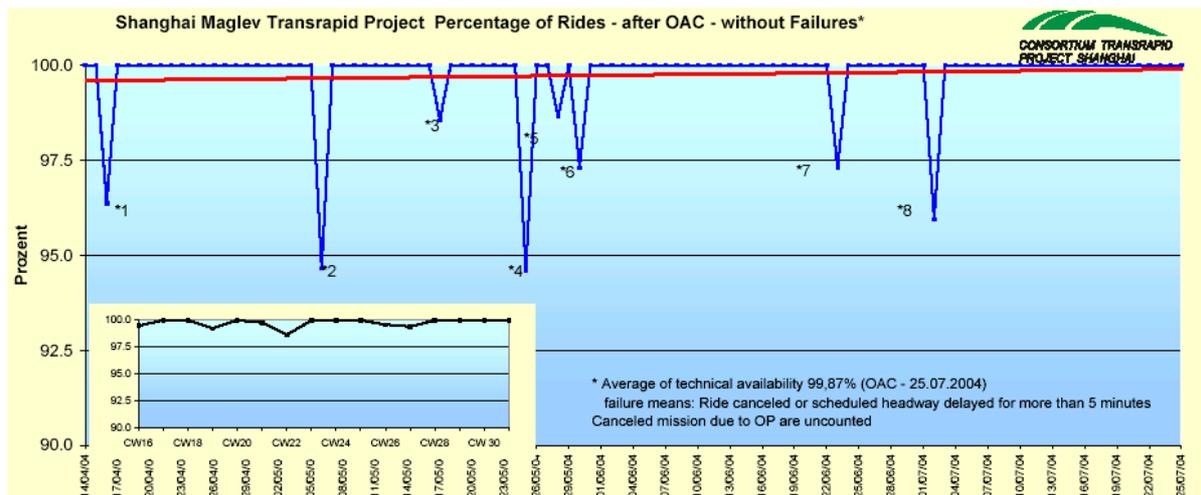


Figure 8; Technical availability of the Transrapid system

The success of the project is due entirely to the people involved and I have to thank everybody for being part of the team.

Additional facts are:

- Use of modern communication technologies like email, fax, video-meetings, in other words less paper work to bridge the distance between two continents
- Communication at its best through good personal relationships
- Processing the job to gain an advantage from the time difference between China and Germany

- Good understanding of intercultural differences of everybody involved on both sides
- Getting the right information at the right time for the right person
- Integration of Chinese personnel in supplier teams and training of customer staff
- Being a reliable partner throughout the whole project
- Quick decisions and high flexibility
- And, last but not least, open feedback should not just be a measure, but more project culture

Figure 9 shows one example of how to realize the facts mentioned above.



Figure 9; Drake boat race

The above photo symbolizes how to get strong, fast and successful. Join a team, work hard and in harmony together, have good control over what you do, be well prepared and you will win the race.