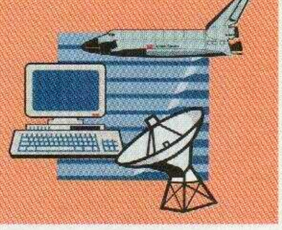
# Technology Today



Alan J. Pierce

## 21世紀へスピードアップ、山梨リニア実験線

**Translation: "Speed-Up for the 21st Century—the Yamanashi Maglev Test Line"**

The Japanese are now testing a fully functional 11.5-mile Maglev system. As this system passes operational tests that began in the spring of 1997, the line will be extended so that it eventually connects Osaka and Tokyo. The Japanese Railway Technical Research Institute's Maglev vehicles are designed to travel in a U-shaped guideway with no physical contact with the guideway walls.

To accomplish this task, levitation coils have been placed on the side walls of the guideways. The train is the superconducting magnet, and as it passes these induction coils it induces the levitating magnetic field. These electromagnetic forces then push and pull the train so that it is suspended in the middle of the guideway. The repulsion and attraction forces of magnetism are so reliable that these trains will be able to travel within their narrow guideway at speeds of 300 miles per hour.

To build this Maglev system it was necessary to build a relatively light superconducting magnet and a cost-effective method of lowering the magnet's working temperatures into the cryogenic range (for this Maglev system -269° C). The magnet is made of a niobium-titanium alloy which is a material that loses all electrical resistance (becomes a superconducting magnet) at a cryogenic temperature that can be sustained by liquid helium. Providing enough electric power to sustain the superconducting magnet isn't a significant problem because once energized, the superconducting magnet doesn't lose its electrical charge for a very long period of time.

To put this statement into a context that we can all understand, how long would the batteries in your CD player last if the entire device worked without any electrical resistance? Did you consider indefinitely as a possible answer?

The engine and braking system for this Maglev train is also magnetic repulsion and attraction. Alternating current energizes propulsion coils located on the walls of the guideway. These propulsion coils set up a shifting field that actually propels the Maglev through their pushing and pulling action. The computers that control the system can use this same force to accelerate or stop the train.

An interesting sidebar to Maglev is an exploration of all technological devices that are based on the principles of magnetism. So many of our communication, transportation, manufacturing, construction, and biotechnology systems couldn't exist if magnetic attraction, repulsion, and other laws of electrical charges didn't exist.

Let me include a technology challenge for you and your students: How many processes and inventions can your students name that couldn't exist without magnetism? The smallest item on your list is the entire field of nanotcchnology where the construction of microscopic machines is accomplished through the attraction and repulsion of extremely small electrical charges.

**Recalling the Facts:**

1. How does this Maglev train control its magnetic levitation to stay afloat in the guideway?
2. How does this Maglev train use its supermagnet for propulsion and braking?
3. What is most significant about the Osaka to Tokyo Maglev line?

*This month's column could not have been completed without the assistance of the staff of the Japanese Embassy in New York City. They were my guide and, at times, interpreters who helped me to communicate with the Railway Technical Research Institute in Japan.* TD

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