Imagine If You Will...

by Jeff Cooper

Paris 1895: Konstantin Tsiolkovsky gazes upward at the Eiffel Tower and like Jack in the classic fairytale, *Jack and the Beanstalk,* he envisions the structure as the anchorage point of a 36,000—meter tether that would, on the outer end, terminate at a "celestial castle." The tether would be the guide system for the "heavenly funicular" (elevator) that served his vision.

Russia July 31, 1960: Yu Artsutanov says, "The electric train gives a last whistle, slowly picks up speed and darts vertically upward on the web of delicate threads. Then the first layer of clouds is left behind. The speed of movement grows ever more…behind are transparent packs of silver clouds." The dream persists.

Flash forward: Imagine if you will, entering an elevator at the lobby landing and as it accelerates away from the floor, a synthetic voice enunciator heralds "second stop solar electric station, third stop solar greenhouses, fourth stop galactic observatory, fifth stop fuel depots, sixth stop interplanetary shuttle docking."

Although sounding far fetched, this is a concept that has evolved from the conceptual to research and development, and in the next 10 to 15 years may become a reality. Peer institutions such as Michigan, Auburn, North Carolina State, Michigan Tech, Virginia Tech, University of Colorado Boulder, Case Western, British Columbia, and the University of Saskatchewan are engaged in the Elevator 2010 competition to develop a vehicle that will ascend a 62,000-mile-long nanotube composite ribbon for delivery of payloads to space.

NASA, Gizmonics, Carbon Designs Inc., American Institute of Aeronautics and Astronautics, United Technologies (Otis Elevator), and many others have devoted resources to the pursuit of this possibility. In fact, NASA has elected to fund Elevator 2010 with $200,000 in prize money through its Exploration Missions Directorate, Centennial Challenges Program to promote the design of the vehicle that will traverse the tether.

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Since publication of the first American Society of Mechanical Engineers (ASME) elevator code in 1921, code organizations in other countries began developing their own codes, and by 1993, the number had peaked at nearly 30 different elevator codes globally.

Today, the numbers are dwindling and most of the international market is using either ASME A17.1, EN81, or the Japanese Standard. The introduction of EN81-1 and EN81-2 in 1998 took the European lift market from a prescriptive-based code system toward a performance-based code, and this as well is the direction in which ASME A17.1 is going. In 2000, efforts toward harmonization of A17.1 and B44 (Canadian Code) laid the foundation for substantial changes in the North American elevator market and confirmed that competition in the global market will require more standardized code requirements that will not present trade barriers and financial exclusion from foreign markets.

The ASME A17 New Technology Committee is actively engaged in drafting a performance-based standard to address analytical methodology for non conventional design. Parallel efforts include a draft suspension standard, which is intended to include synthetic rope and coated steel belts, as well as an array of conventional wire rope. Such issues as suspension means, machine room-less elevators, "self-healing" (assessment and restart after seismic trip), and "self-propelled cabin" elevators, will be a few of the issues addressed.

For a number of years, the preface of A17.1 has stated, "Where present requirements are not applicable or do not describe new technology, the authority having jurisdiction should recognize the need for existing latitude and granting exceptions where

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the product or system is equivalent in quality, strength or stability, fire resistance, effectiveness, durability, and safety to that intended by the present code requirements." This is being applied literally and could well be the trend from now on.

The draft New Technology Standard proposes that an independently certified and audited third-party assessment of "equivalent safety" will be overseen by the Accredited Elevator and Escalator Certifying Organization. This is, for the most part, already in place.

We are seeing the introduction into the domestic market of machine room-less (MRL) systems, which are addressed by supplement in ASME A17.1S-2005. These units are appealing to architects as well as to owners because no area is required for a "machine room." Another appeal is energy conservation, which in some cases is estimated to be 35 percent less than a conventional traction elevator and 75 percent less than hydraulic elevators. Environmental concerns about "direct acting" hydraulic elevators (jacks buried in the ground) have also added to the MRL appeal and helped to promote the use of hole-less hydraulic applications (roped hydraulic and telescopic) that were more of a novelty 10 to 15 years ago.

Some of these systems are already utilizing synthetic and belted rope technology. These products are being heavily marketed by the major elevator companies and are beginning to be requested by owners. As the more exotic control platforms and machines start to appear, owners will need to keep in mind that the proprietary nature of some of these systems seriously limits competitive service contracting.

Some of the products have developed problems in application and are resulting in some apprehension by Authorities Having Jurisdictions (AHJs). As was mentioned earlier in the A17.1 excerpt (Preface/New Technology), more of the onus will fall on the AHJs. This is causing concern for some from both a liability and resource standpoint. Some jurisdictions may not possess the technical prowess to effectively evaluate all aspects of new elevator systems and as a result will be inclined to limit new technologies. In fact, the possibility exists that a variance(s) may be required for installation which in most cases must be filed/signed by the owner and introduces the possibility of some liability.

A trend that is developing in the United States is adoption of the "Model Elevator Law" (copy available at www.neii.org). Among other requirements, the document focuses on licensing procedures and code and inspection requirements that include licensing for inspectors, mechanics, and contractors. The document defers to inspector requirements (QEI certification) and in sections 23.1, 23.2, and 23.3 the responsibilities of the owner to ensure that proper maintenance and testing is performed. Currently about 12 states have adopted parts of the document. Owners should be aware of its content if their jurisdiction is entertaining thoughts of adoption.

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In the jurisdiction that I operate (Indiana) we have come from governance under A17.1, 1987 that ran October 1989 through January 2002 to the adoption of A17.1 2000 with IC-4-22-2 and IC 22-13-2.5 (Indiana Code) laying the framework for adoption of future versions. One of the more significant codes slated to be adopted in 2006 is A17.3 (Safety Code for Existing Elevators and Escalators).

As a point of reference, do you remember the rules so near and dear to our hearts and wallets; A17.1 1996 rule 302.3d and A17.1 2000 rule 8.6.5.8? In a nutshell, these were the combination of rulings that compelled many to change their single bottom jacks and for our institution alone, we will pay between $500,000 to $750,000 to reach compliance. Although these requirements came as the result of a few catastrophic jack failures during the 1990s, some of which resulted in serious injury and death, they do little to account for the limited resources many owners have at their disposal.

The application of A17.3 states: "Existing applications, as a minimum, shall meet the requirements of this Code." A specific consideration for owners should be rule 3.11.3 (firefighter's service) which by itself, if adopted, would probably far surpass the expense of hydraulic jack replacements. My best estimate for our university, if the document were adopted in its entirety, could easily exceed $5 million.

Another aspect of the adoption of code changes in Indiana has been the implementation of affirmations and attestations. The permit for installation/alteration has a section that requires the owner, under penalty of perjury, jail time, and a possible $10,000 fine to affirm that "the regulated lifting device will be installed or altered in accordance with all applicable rules adopted by the commission…." The same applies to "Notice of Compliance/Completion" and "Safety Test Attestation" forms, which also require qualified elevator inspector oversight. This forces the owner to either assume the liability or obtain the services of a knowledgeable third party whose services are becoming more in demand and whose cost reflects that accordingly.

As we move from the well defined and predictable "prescriptive" code

domain to the less defined "performance" code realm, more of the liability will begin to fall on authorities having jurisdiction and subsequently may be shared by the owners. To stay ahead of events relative to the new changes, owners will have to continually educate themselves and their staffs or ultimately rely on a third party to ensure that all the required issues are addressed. As the global market drives the industry towards global code harmonization and technology stretches the bounds of current design, the changes will come at a rapid pace and the challenge to keep up will require dedicated commitment to the change. As we move toward an interim period that may include installation by variance, the potential result may be difficult to manage by authorities having jurisdiction. At a minimum, the process will be slowed and in many cases overloaded, and many owners will find the process confusing at best.

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As owners are required to become more proactive, bear in mind that from a legal standpoint ignorance of process and the law will more than likely not be a viable excuse should an issue result in litigation. Like it or not, change, like sweet cream butter on warm French toast, will spread liberally through the industry. The best insurance against ending up as someone's breakfast will be education. We are in the employ of institutions that develop and sell education so the challenges ahead should be something with which we are well equipped to handle.

Over the last eight years efforts have been made in the academic community to stay abreast of changes by annual conferences (VTCCU http://fmsd.gsu.edu/Vtccu/exhibitors.asp) which have been hosted by Purdue, Michigan, and Georgia State universities and have focused exclusively on elevator-related issues. Another result of this effort has been the "Highlift" network that addresses a myriad of elevator issues and is an open platform exclusively for colleges and universities.

So, as we grapple to deal with issues where literally "the sky" may be the limit, it is nice to know that we're not going it alone. I personally am leaning toward the viewpoint addressed in a November 16, 2005 article in the *Wall Street Journal* titled, "New Buildings Help People Fight Flab/Designs Encourage Climbing Stairs and a Lot of Walking."