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The Current Source

Newsletter of the Schenectady Section of the IEEE

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Chairperson's Message

President Bush announced in his most recent State of the Union address the launch of the "American Competitiveness Initiative". The plan is to double federal funding of research in basic areas like nanotechnology, supercomputing and alternative energy; make permanent the R&D tax credit; and train 70,000 additional school science and math teachers. We need to give this initiative the same focus and energy that was given in the 60s to science and math education. We don't have the shadow of Sputnik or the cold war, as we had then, for inspiration. However, the threats we are facing nowadays are different and, maybe, more severe.

Globalization has changed the landscape of technology and the inadequacies of our systems of research and education could even pose a threat to our national security. The U.S. is slowing down in aspects of science and technology while others speed up. We are still leading the world in economic performance, science and technology, business and government efficiency and in the strength of infrastructure. But if current trends continue, that won't be true much longer. This is shown in the key measures of innovation in terms of new product development, publications of articles in scholarly journals, and granted patents.

Experts in business and academia have been warning for decades that US science was heading for trouble for three simple reasons:

• The Federal Government has steadily been cutting back on investment in R&D.

• Corporations under increasing pressure from their stockholders for quick profits, have been reducing investment in R&D and focusing on short-term products.

• The quality of math and science education in elementary and high school has dropped, leading to a decrease in students majoring in technical fields in college and graduate school.

The National Academies of Sciences and Engineering produced a long report on the assessment of the U.S.'s eroding superiority in science and technology. Titled "Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future", the report outlined in detail just how bad the situation was in nearly every area of research and called for new government funding.

We, as engineers and scientists, need to support this effort. We need to get our kids excited about science and technology, not only to practice engineering and science, but also to work as entrepreneurs and politicians appreciating and supporting science and technology. ■

Email us with your thoughts!
Sam Salem, s.salem@ieee.org

Call for Contributions

The Current Source is always open for contributions for future newsletters. There is certainly much more going on in this area then gets profiled in the newsletter. Do you have an article about a historical moment, a future event, or a notable discovery that might be of interest to the local IEEE community? How about a picture of some momentous occasion? Please contribute! Staff editors can even take your bulleted list and turn it into printable article if writing does not appeal to you. We do however have to reserve the right to refuse any material of a commercial nature.

The Current Source is published twice a year by the Schenectady Section of the IEEE. If you are interested in volunteering for The Current Source or wish to submit material for consideration, please contact the editor.

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The Executive Committee wishes to thank Srinivas Pillutla for his years of hard work as the newsletter editor.
His dedication and effort will be missed!

Communication Across The Atlantic

An historical perspective of technical innovation

The Institution of Engineering and Technology is pleased to announce a meeting on September 15/16 at The Schenectady Museum on Communication Across the Atlantic: a historical perspective of technical innovation. For those who haven't heard, the IET is a UK-based professional institution, formed by the recent merger of the Institution of Electrical Engineers and the Institution of Chartered Engineers. The event is co-sponsored by The Schenectady Section of IEEE as well as The Museum and Planetarium.

Dr. Brian Bowers, formerly Senior Curator at London's South Kensington Science Museum, will give the opening talk on Friday, by discussing Early Anglo-American Electrical Connections. These were about connections by electricity rather than with electricity, since so little was then known about this new phenomenon. He was till recently Chair of the IEEE Professional Network on the History of Technology, and will speak about visits made by Joseph Henry – of Schenectady fame – A.D. Bache and Samuel Morse, with British pioneers such as Michael Faraday, Charles Wheatstone and W.F. Cooke, several decades before the first wired connections were made. The physical hazards of crossing the Atlantic by sailing vessel in the 1830s no doubt concentrated their minds on the telegraph as a way of eliminating distance. Henry and Bache visited England in 1837, and conducted experiments with Michael Faraday, Charles Wheatstone and others. Their immediate object was to show that the current from a thermopile could produce a spark. This rather abstruse experiment was part of the research in which they were all engaged: seeking to understand the nature of electricity, and what it could do. At the time Wheatstone was working on an electric telegraph, and on electric measurements. Partnering with W F Cooke, he patented the 'five needle' telegraph, which went into commercial service in 1838 on a new railway line running west from London. Also in

Continued on next page...

Communication Across the Atlantic Continued from page 2

1838 Samuel Morse visited London and sought an English patent, unsuccessfully, for his telegraph. He met Wheatstone, whom he described as 'a man of genius and one with whom I personally was much pleased'. Thus the telegraph pioneers on both sides of the Atlantic shared some of their early ideas.

On the Saturday morning, Dr. Donard de Cogan, Reader in the School of Computing Sciences at the University of East Anglia, will speak on The Interaction between Business and Technology in Early Transatlantic Cables. The establishment of the Victorian internet, the world network of submarine telegraph cables had as profound an impact in its time as today's Internet is having for us. It is interesting to draw parallels. The former was established under the hegemony of the British Empire, while the latter has grown out of pioneering work in the United States. It is equally interesting to observe the differences. The world-wide web uses stable technology, which is incredibly cheap, when measured in terms of bits per dollar. It is altruistic and the information is distributed. Cable communications, on the other hand used untested technology that was forced to adapt to the pressures that were put upon it. It was hampered by the limitations that lack of bandwidth caused and the cost per bit was enormous. In essence, it was dominated by the information conduits rather than by the content. Those who managed the conduits had limitations and the economic models by which they operated are very different to what we see in use today.

In assessing the interaction between the business of communications and the technology by which it was achieved in the period 1866 - 1880 the speaker is in a unique position. His wife's family claims four generations of telegraph cable operators, beginning with her great-great grandfather, James Graves. He was the first superintendent of the Valentia island cable station at the Eastern termination on the West coast of Ireland. In the last century, a granduncle worked for the Italian Cable (Italcable) at Anzio from 1927 until Mussolini removed all non-Italian staff. In this talk, use will be made of some novel computer-based methods for the presentation of parallel-themed historical information, which he hopes others might find useful.

To conclude the event, Mr. Edward L. Owen, IEEE Fellow, formerly of GE Power Systems and well-known for his historical research in the Schenectady area, will speak on Trans-Atlantic Radiotelephone Communications - the Early Days. Telegraphy provided the first means to communicate great distances and with great speed. The telephone later provided a means to transmit human voice in a form recognizable to the human ear. Both of these means of communicating at a distance required a physical wire to act as an electrical conductor from source to receiver. Introduction of radiotelegraphy overcame the need for a wire to send telegraph signals but the great "crashing" spark-gaps were considered essential and did not allow for transmission of human voice. Reginald Fessenden conceived the idea that a continuous-wave electrical signal could convey human voice without the need for wires. It took several attempts and competition between inventors to finally achieve his objective. In the end, it was Ernst Alexanderson and his high-frequency alternator that provided the continuous-wave carrier necessary to transmit human voice over great distance and with great speed.

It is hoped to mount a parallel Museum Exhibit Transatlantic Telegraphy: Then and Now to run contemporaneously with the event, with interactive aspects such as contrasting the signaling rates achieved with the first effective cable (1867 – about 1.5 bits/second) and current fiber optic rates, measured in Gigabits per second. The event is supported by a number of organizations. It will be open to the public free of charge, but registration will be required. There will be a Buffet Meal on the Friday evening for which a modest charge will be made.
Visit the web site of the IET New England Branch for further details: It will be updated as further details are announced. ■

local.iee.org/usa/new_engl/schenectady2006.php

The Schenectady Museum and Planetarium September 15-16th 2006

Friday September 15th

5.30 pm – Reception, Museum Atrium – Open to the public

5.55 pm – Welcome: Mr. David Owen, Chairman IET New England Branch

6.30 pm – Lecture: Brian Bowers

8.00 pm – Dinner
(reservations required $25 per person)

Saturday September 16th

9.00 am – Lecture: Donard deCogan

10.30 am – Coffee and Exhibits

Past, Present, Future: Landing of the Transatlantic Cable, 1866

A permanent electrical communications link between the old world and the new was initiated at this site with the landing of a transatlantic cable on July 27, 1866. This achievement altered for all time personal, commercial, and political relations between peoples on the two sides of the ocean. Five more cables between Heart's Content and Valentia, Ireland were completed between 1866 and 1894. This station continued in operation until 1965.

On Friday, 13 July 1866, the Great Eastern, by far the largest ship afloat, left Valentia, Ireland, (corresponding IEEE Milestone) with 2730 nautical miles of cable in her hold. Fourteen days later 1852 miles of this cable lay at the bottom of the ocean, the ship was at anchor in Trinity Bay, Newfoundland, and the old and new worlds were in permanent telegraphic communication.*

The quest to establish a transatlantic telegraphic link took 12 years and five attempts at laying the cable, demanding the confidence and expertise of countless financiers, electrical engineers, scientists, and sailors. Cyrus Field, who had made enough money in the paper trade to allow him to retire at age 35, decided to back the laying of the transatlantic cable in 1854. He talked to Matthew Maury, a leading oceanographer, to find out if laying a telegraph cable on the ocean floor between Newfoundland and Ireland was possible, and then to Samuel Morse to ask if, once in place, such a cable would work. After being assured that the project was indeed feasible, Field was ready to seek financial backers.

Four of New York's richest men --- Chandler White, Peter Cooper, Marshall Roberts, and Moses Taylor --- joined Cyrus and Dudley Field to found the New York, Newfoundland, and London Telegraph Co. Their first step was to lay submarine cables between Cape Ray, Newfoundland, and Cape Breton Island, Nova Scotia, and then between Cape Breton Island and the Nova Scotia mainland. Through a combination of submarine cables and overland lines, St. John's, Newfoundland, and New York City were connected in 1855.

Field and nine associates then formed the American Telegraph Co., which soon ranked As one of the top six telegraph companies in North America. By mutual agreement, these companies established regional operating boundaries, and Newfoundland, New Brunswick, and the United States' eastern seaboard became American's territory. A clear path of communication from Canada to Florida now existed for the messages which would come over the proposed transatlantic cable.

The next several months were spent in establishing still another company, the Atlantic Telegraph Co., choosing the cable design, manufacturing the cable, finding backers, and securing agreements of support of the project from both the British and American governments. Then, on 5 August 1857, the American steam frigate Niagara and the Royal Navy's steamer Agamemnon left Valentia Bay, Ireland, each with half-an-ocean's length of cable in her hold. After laying about 400 miles of cable, however, the line snapped and could not be recovered from the ocean floor.

During the next ten months, improvements were made to the machinery for paying out the cable, a better insulating compound was developed, William Thomson (later Lord Kelvin) invented his mirror galvanometer, which was used for improved detection of the signals coming over the cable, and still more capital was raised. The cable, which had been stored on the docks at Plymouth, England, was reloaded onto the Niagara and the Agamemnon, and the ships left Valentia Bay on 10 June 1858. This time, only 160 miles of the cable had been laid when it broke. Field pushed to try again immediately. The two ships met in mid-ocean on 29 July, spliced the cable, and steamed off in opposite directions, laying the cable as they went. Both reached their respective ports in Newfoundland and Ireland on 5 August 1858; transatlantic communication by telegraph was a reality. The glory was short-lived, however. The cable was dead by 18 September.

This was the worst set back in the troubled story of the transatlantic cable. It was nearly impossible for Field to find backers for another attempt. The British government was reluctant to increase its support of the project. And the political situation in the US in 1859 gave little priority to Field's venture.

To investigate the special problems of submarine cables, a commission was set up under the British Board of Trade. Between 1859 and 1860, the commission, which included such notables in the field of telegraphy as Charles Wheatstone and Latimer Clark, carried out experiments on the construction, insulating, testing, and laying of cables. The final opinion of the commission was that... a well-insulated cable, properly protected, of suitable specific gravity, made with care, and tested under water throughout its progress with the best known apparatus, and paid into the ocean with the most improved machinery, possesses every prospect of not only being successfully laid in the first instance, but may reasonably be relied upon to continue for many years in an efficient state for the transmission of signals.**

But, even with this official vote of confidence, Field was unable to interest the British government, which felt that support of the cable project might imply an alliance with the industrial North of the war-torn United States. Finally, an encouraging break came in 1862 --- Glass, Elliott and Co. offered to make and lay the new cable and to put up $125,000 as well, in return for reimbursement of materials and labor costs, plus an additional 20% of the cost of the line. With this promise of support, Field then turned to the private sector in both Britain and the US to raise the necessary capital. Although this canvassing was quite lucrative, by the beginning of 1864 more than half of the needed funding still had to be raised. It seemed that all of the government and private sources had been tapped to their limits.

Then, a catalyst appeared in the form of Thomas Brassey, a railroad entrepreneur and London financier. After talking with Field, Brassey agreed to be one of ten to supply the remaining funds. Brassey's endorsement was enough to bring John Pender, a Manchester industrialist, into the group of ten. Pender took things a step further, though, by heading the merger of Glass, Elliott and Co. and Gutta Percha Co. to form Telegraph Construction and Maintenance (TC&M). Not only did TC&M handle all aspects of the cable's construction, but the company also subscribed the remaining necessary capital. All Field needed now was a ship to lay the cable.

Isambard Kingdom Brunel's Great Eastern had captured the popular imagination. She was by far the largest ship afloat, measuring 693 feet in length and 120 feet in width. She could carry a load of 18,000 tons in her double hull and her coal bunkers could hold enough fuel to take her from England to Australia and back. From the beginning, though, the Great Eastern had been a major money loser. So, when she was put up for auction in January 1864, Daniel Gooch, with the financial help of Field and Brassey, bought the Great Eastern for $125,000 (she had cost $5 million to build) and put her at the disposal of the cable laying expedition.

On 23 July 1865, the Great Eastern began paying out the new cable, which had been manufactured according to much stricter technical specifications. But, once again, the cable accidentally snapped and was lost --- this time only 600 miles out from the Newfoundland coast. This trip proved, however, that the improved methods of making and laying the cable were sound, and few people doubted that the next attempt would succeed.

So, again, capital had to be raised. The newly-formed Anglo-American Telegraph Co., TC&M, and a few British capitalists answered the call. A new cable was constructed, the Great Eastern was again called into service, and, on 13 July 1866, the cable laying began. Two weeks later, the cable was landed and began operating at Heart's Content, Newfoundland. The Great Eastern then returned to the spot where the 1865 cable had been lost, retrieved it from the ocean bottom, spliced it, and paid out the remaining 600 miles back to Newfoundland. By 8 September 1866, not one but two telegraph lines were sending messages across the Atlantic. ■

Finn, Bernard S. "Growing Pains at the Crossroads of the World: A Submarine Cable Station in the 1870s," Proc of the IEEE, 64, no. 9 (Sept. 1976). p.1287

Security Without Wires

by Howard Halstead, Chair - Computer Society

Over 40 of us enjoyed a presentation by Michael J. Santarcangelo on "Security Without Wires". We learned about how to connect our computers to our home network as well as connecting our computer at a local coffee shop.

Michael was able to delivery his message in an entertaining way, so that all would enjoy the presentation while learning something about using wireless network more securely. Michael is the founder of the Security Inner Circle (http://www.security innercircle.org), the founding President of the Tech Valley (New York) ISSA Chapter, a secure member of InfraGard and serves on several International committees dedicated to advancing the field of information security. If you missed this presentation, you have a chance to listen to him via podcast available at The Security Catalyst. Just visit: http://www.securitycatalyst.com/

***Coates, Vary T. and Bernard S. Finn. A Retrospective Technology Assessment: Submarine Telegraphy. The Transatlantic Cable of 1866. San Francisco: San Francisco Press, Inc., 1979, p. 19*

Capital District Future City Competition 2006

By Sabir Azizi

To foster interest in engineering, math, and science, the fifth annual Capital District Future Cities competition was held on January 14, 2006 at Rensselaer Polytechnic Institute in Troy NY. The competition allows middle school students to explore imaginative talents and to learn real life application of engineering and technology to develop a realistic future community.

This year, two hundred ten 7th and 8th grade students from nineteen area middle schools presented 3-D Future City models for judgment on creativity and engineering talents. Through preliminary judging, five teams were selected from which a Regional Champion was chosen to represent our area at the National Competition at Engineers Week in Washington, DC (with an all expense paid trip).

The competition at RPI was fun and humbling at the same time. The students had many great ideas and had put a lot of work into their entries. Among many prizes and awards provided by area businesses and professional groups, the IEEE Schenectady Section awarded a prize titled "Excellence in the Generation and Conservation of Electrical Energy". This award was presented to the students from Doyle Middle School (Troy) for their winning Future city entry named "Reykjavik 2.0", and included $100 for the team and $150 to support the competition. Rebecca Nold and Saber Azizi interviewed the teams and nominated the candidates for the IEEE prize. Given the creativity and innovative imaginations demonstrated, it was tough to narrow them down. ■

Doyle Middle School team with "Reykjavik 2.0"

For more information:
www.capitaldistrictfuturecity.org

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