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OLCOTT MEMORIAL ORATION 2005

New frontiers of engineering

The Olcott Memorial Oration 2005 delivered by Old Anandian Professor Nimal Rajapakse, Professor of Mechanical Engineering University of British Columbia, Canada.

Venerable Maha Sangha, Principal of Ananda College, Past Principals, Past and Present Teachers of Ananda, Distinguished Invitees, Fellow Anandians, Ladies and Gentlemen.

It is indeed a great honour for me to deliver the 2005 Olcott Oration, and I am most grateful to the President and the Executive Committee of the Old Boys' Association for giving me this opportunity.

Thirty-three years have passed since I left Ananda College after completing Grade 12. Four generations of my family studied at Ananda. My late grandfather, Don Elias Rajapakse, studied at Ananda and gained admission to the Ceylon Medical College.

My late father, my uncles, my bother, my nephew and cousins also studied at Ananda. I came to Ananda College in Grade 3 after spending a year at a school in my village near Attanagalla and another year at Olcott College which was then amalgamated into Ananda College in 1962.

This oration is held in memory of a great man, Colonel Henry Steele Olcott, who played a leading role in establishing Ananda College and laid the foundation for developing many other leading schools in Sri Lanka. While preparing for this oration, I decided to refresh my memory of Colonel Olcott's life, Colonel Olcott was the President, Founder of the Theosophical Society in America.

He came to know of Sri Lanka (called Ceylon at that time) after reading an article published in the Ceylon Times about the famous debate of Ven. Gunananda Thera held in Panadura. Colonel Olcott and Madam H.P. Blavatsky (Co-founder of the Theosophical Society) arrived in Galle on May 17, 1880.

Colonel Olcott undertook a concerted effort to revive the Buddhist culture in Sri Lanka and to build a network of schools to provide education to Sri Lankan children who had very limited access to education at that time. As a result of his efforts, the Buddhist English School was established on November 1, 1886 at 61, Maliban Street, Pettah, renamed Ananda College in 1895.

Although founded under the patronage of Buddhist men and women, Ananda's doors have always been open to students and teachers from other religions. The school has maintained an educational environment built on strong discipline, academic excellence, mutual respect, religious harmony, openness and inclusiveness for nearly 120 years.

Ananda College is a symbol of the qualities and vision of great men like Colonel Olcott. Many of us gathered here today are truly indebted to Colonel Olcott and his team for the superior education provided by Ananda College and other BTS schools in Sri Lanka.

When the organisers of this oration invited me to speak, I decided to talk about engineering for two reasons.

The first is obvious, as engineering is my chosen profession. The second reason is that Ananda College has arguably the best record, among all schools in Sri Lanka, of nurturing young Sri Lankans to become engineers. Old Anandians have made significant contributions to the practice and teaching of engineering in Sri Lanka and around the world. There are many distinguished engineers who studied at Ananda.

It is difficult to mention everyone by name but I would like to talk about a few. The pioneer of hydroelectricity development in Sri Lanka the late Mr. D.J. Wimalasurendra, C. Eng., studied at Ananda. Mr. Wimalasurendra was the first Sri Lankan to recognise the vast amount of hydroelectric power that could be harnessed form the country's rivers.

In 1918, he prepared a seminal paper summarising his ideas for the development of hydroelectric power. His ideas were not well received by the Government of Ceylon and he retired from government service in 1930. The importance of hydroelectric power was recognised after Sri Lanka gained independence. Today we see the benefits of Wimalasurendra's vision throughout the country.

The late Dr. B.M.A. Balasuriya, arguably the best structural engineer Sri Lanka ever had studied at Ananda. He was also my teacher at the University of Moratuwa. I would also like to recognise two leading engineering educators who studied at Ananda. They are Prof. M.P. Ranaweera, former Dean of Engineering of the University of Peradeniya and Prof. K.K.Y.W. Perera, former Dean of Engineering of the University of Moratuwa.

Mr. H.B. Jayasekera, former Chairman of the Central Engineering and Consultancy Bureau, is another distinguished engineer who studied at Ananda. Many Old Anandians have settled abroad and enjoy distinguished careers in engineering. I would like to mention Dr. Chandana Wirasinghe, who is currently the Dean of

Engineering of the University of Calgary, as an example.

Why has Ananda College been so successful in nurturing future engineers? I think it is because of outstanding teachers and mentors who encouraged many of us to study Mathematics and pursue a career in engineering. I would like to pay special tribute to our great mathematics teacher and mentor, the late Mr. C.M. Weerarathne, who was an Old Anandian himself.

He had a distinguished teaching career at Ananda and served the school for nearly forty years. I am glad that Mr. Weeraratne's daughter, Kusum, is in the audience and that she is also an old Anandian.

Ladies and Gentlemen, Let me now turn to the new frontiers of engineering. Engineering is a marvellous discipline to study, research and practice. It is about great innovations, and has had a tremendous impact on modern society and our quality of life.

There are many new frontiers of engineering and I do not have the time to talk about all of them. Even in the few I am interested in. I have a lot to learn. I will talk about two frontiers that will have a significant impact on modern society and quality of life.

Technological development will continue to accelerate at a rapid speed in this century, following the great strides made in the nineteenth and twentieth centuries. The frontiers of engineering are advancing on many unexplored territories.

In the 19th and 20th centuries, we were driven by the desire to go big. We have seen giant skyscrapers, suspension bridges, aircraft, chemical processing plants, etc. Such developments significantly improved our standards of living. The rise and fall of various technology sectors constitute a normal development cycle and will continue to happen in the future.

For example, railroad building in the western world peaked during 1845-1900 and died down several decades later. The aviation industry peaked in the 1970s and thereafter reached a steady state. The same is true of the information technology industry which peaked during the last two decades of the 20th century and has seen a gradual downturn over the past five years.

Micro Electro Mechanical Systems (MEMS) and Nanotechnology

We have gone through four waves of technological advances over the past three centuries and are now in the fifth one. The fifth wave corresponds to MEMS and Nanotechnology. In contrast to the technological goals of the 19th and 20th century to make things bigger, the fifth

wave of technology takes us in the opposite direction to analyse, design, build and manipulate objects that are too small to see with the naked eye.

The MEMS technology involves objects with dimensions ranging from few millimetres to micrometres whereas Nanotechnology involves objects with dimensions ranging from one to one hundred nanometres.

Before I proceed to give some examples of new engineering developments related to the fifth technology wave, it is appropriate to talk about a Nobel Prize winner in Physics, the late Prof. Richard Feynman, who taught at the California Institute of Technology, Prof. Feynman was a visionary who predicted the fifth wave of technology in a talk given in 1959 at the annual meeting of the American Physical Society.

The title of Prof. Feynman's talk was "There is Plenty of Room at the Bottom" and he repeatedly emphasized the word 'Plenty' during his talk. Twenty-four years later (i.e. 1983), Prof. Feynman gave another fascinating talk at the Jet Propulsion Laboratory in Pasadena, California. The title of the talk was "Infinitesimal machinery". The Journal of Microelectro Mechanical Systems published the texts of these two talks in 1992 and 1993.

In these talks, Prof. Feynman planted the seeds of MEMS and Nanotechnology. He asked, Why can't we write the entire 24 volumes of the Encyclopedia Britannica on the head of a pin? He examined biological systems at the cellular and molecular levels and contemplated building mobile micro-robots for surgery.

He speculated about one of the most intense research areas for engineers and scientists working on Nanotechnology today building devices at the atomic and molecular levels! He went on to talk about the possibility of another current hot research area in Computer Engineering and Physics quantum computing.

The fifth wave of technology, which we are riding today, is about Prof. Feynman's ideas and vision. Many things he mentioned have become possible in recent years or will become possible over the next few decades. Let me highlight some recent advances and future directions in MEMS and Nanotechnology.

MEMS technology came to the forefront of engineering in the early 1990s although some applications existed before that.

It is a technology similar to that used for making computer chips. Today a computer chip, the size of your thumb can perform 10 billion operations per second.

Advances in semi-conductor technology for more than a

decade have enabled building very small-scale mechanical devices and objects such as beams, plates, gears, motors, actuators, etc. Could we build a micro-robot that navigates through blood vessels using bio-sensors to reach the site of a cancer for controlled delivery of a drug?

This would be a much more effective way to treat cancer patients than current approaches such as radiation therapy.

Research is under way to use MEMS technology to restore vision to people suffering from certain types of blindness. According to an article published in the Mechanical Engineering magazine of ASME, a group of engineers from several leading laboratories in the United States is working together to design and build a microelectro mechanical device that can be implanted on the surface of the retina.

In this article retina, a microelectrode array will perform the function of normal photoreceptor cells, to restore vision for people whose photoreceptors cells have been damaged. The goal is to build an array of 1,000 electrodes, with each electrode having a diameter of 50 um.

(Continued on Monday)

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