

**Complete coverage of Ex President Abdul Kalam's Visit to BPGC,
(Sat, Feb 7 2009)**

Address and interaction with the Students during the inauguration of QUARK 2009

Convergence of Technologies:

Technology is a non-linear tool which can effect fundamental changes in economic competitiveness

I am delighted to participate in the inauguration of QUARK? 2009 and address the students and Faculty members of Birla Institute of Technology and Science, Goa Campus and other students from many colleges of Goa. My greetings to all of you.

I take this opportunity to congratulate all the Faculty members, Students and staff of this Institute and all those who have contributed in promoting good educational standards in this institute. While I am with you today, I recall my visit to Dubai Campus of BITS, Pilani at Dubai Knowledge Village on 20th October 2003. I had a beautiful experience of addressing and interacting with the Students and Faculty members. Since I am in the midst of prospective scientists and technologists, I would like to share with you few thoughts on the topic. Convergence of technologies.

Convergence of Technologies:

The information technology and communication technology have already converged leading to Information and Communication Technology (ICT). Information Technology combined with bio-technology has led to bio-informatics. Now, Nano-technology is knocking at our doors. It is the field of the future that will replace microelectronics and many fields with tremendous application potential in the areas of medicine, electronics and material science. When Nano technology and ICT meet, integrated silicon electronics, photonics are born and it can be said that material convergence will happen. With material convergence and biotechnology linked, a new science called Intelligent Bioscience will be born which would lead to a disease free, happy and more intelligent human habitat with longevity and high human capabilities. Convergence of bio-nano-info technologies can lead to the development of nano robots. Nano robots when they are injected into a patient, my expert friends say, it will diagnose and deliver the treatment exclusively in the affected area and then the nano-robot gets digested as it is a DNA based product.

Convergence of ICT, aerospace and Nano technologies will emerge and revolutionize the aerospace industry. This technological convergence will enable building of cost effective low weight, high payload, and highly reliable aerospace systems which can be

used for inter-planetary transportation. Now let me discuss about the importance of research for high quality teaching.

Research teaching Research:

Good teaching emanates from Research. The teachers' love for research and their experience in research are vital for the growth of any institution. An Institution is judged by the level and extent of the research work it accomplishes. This sets in a regenerative cycle of excellence. Experience of research leads to quality teaching and quality teaching imparted to the young in turn enriches research.

During the last 18 months, I have visited and interacted with students and faculty members of 19 foreign universities (10 in America, 6 in Europe and 3 in Asia) and 50 Indian universities. During these visits, I found that all foreign universities and few Indian universities are concentrating on research. For example, Waterloo University, I saw a solar powered car developed by the students which has been driven many parts of the world. The famous Black Berry is the product coming out of Waterloo research. Carnegie Mellon University had developed a robotic car which has participated in an International Competition. Arkansas University and Rice University have realized a solar photovoltaic cell using carbon nano-tube in the laboratory with 50% efficiency against the present 20%. At Banaras Hindu University, I saw the nano-technology based water filter. At Indian Institute of Science, Bangalore, I saw power-generation through blood flow using carbon nano-tube. The research and development in these universities has enriched the quality of teaching and the quality of teaching is enriching the research and development. Wherever I went, I saw that research teaching research each is reinforcing the other. I am sure; these examples will be emulated by the faculty members and students of BITS Pilani Goa Campus.

Dear friends, I was thinking what thoughts I can share with you. As I am with the young students in the process of shaping the vision of your life at this point, I thought of sharing with you some incidents in the life of few great human beings. That will be beneficial in your thinking and in your actions. I would like to share the uniqueness of three great minds, all of them Nobel Laureates, each one having unique traits such as cherishing the Value of Science; planting a tree leads to planting an idea and Birth of Creativity in a difficult situation. Certainly I believe this will enable you to imbibe confidence and vision in your life.

The traits of Nobel minds:

Value to Science: Let me start with an incident about Sir CV Raman ? a Nobel Laureate in Physics for discovering Raman Effect. Raman gives the view that the color of sky is blue due to molecular diffraction, which determines the observed luminosity and in great measures also its color. This led to the birth of the Raman Effect. Raman was in the first batch of Bharat Ratna Award winners. The award ceremony was to take place in the last week of January, soon after the Republic Day celebrations of 1954. The then President Dr. Rajendra Prasad wrote to Raman inviting him to be the personal guest in the Rashtrapati Bhavan, when Raman came to Delhi for the award ceremony. Sir CV Raman wrote a polite letter, regretting his

inability to go. Raman had a noble reason for his inability to attend the investiture ceremony. He explained to the President that he was guiding a Ph.D. student and that thesis was positively due by the last day of January. The student was valiantly trying to wrap it all up and Raman felt, he had to be by the side of the research student, see that the thesis was finished, sign the thesis as the guide and then have it submitted. Here was a scientist who gave up the pomp of a glittering ceremony associated with the highest honour, because he felt that his duty required him to be by the side of the student. It is this unique trait of giving value to science that builds science. Next, let me highlight how planting a tree leads to planting an idea.

Planting of trees is the planting of ideas: I would like to talk about Prof Wangari Maathai who has a passion for environment and bio-diversity and is contributing to the sustainable development and growth of planet Earth. Wangari Muta Maathai was born in Nyeri, Kenya (Africa) in 1940. She was the first woman in East and Central Africa to earn a doctorate degree and to become chair of the Department of Veterinary Anatomy and an Associate Professor. Wangari Maathai was active in the National Council of Women of Kenya and was its Chairman in 1981-87, where she introduced the idea of planting trees with the people and continued to develop it into a broad-based, grassroots organization whose main focus is the planting of trees with women groups in order to conserve the environment and improve their quality of life. Through the Green Belt Movement, Nobel Laureate Prof Maathai has evolved innovatively a movement with 600 community networks across Kenya and branches in 20 countries resulting in the plantation of 31 million trees. She and the Green Belt Movement have received numerous awards, most notably The 2004 Nobel Peace Prize.

Prof Maathai gives a new meaning to the important act of planting a tree by extending it to the whole life, when she says, "the planting of trees is the planting of idea." She highlights the qualities of patience, persistence and commitment in planning and realizing a future, which is what we learn when we plant trees and wait for them to yield fruits for the next generation. She believes that no matter how dark the cloud, there is always a thin, silver lining, and that is what we must look for. The silver lining will come, if not to us then to the next generation or the generation after that. And may be with that generation, the lining will no longer be thin. India values Prof Maathai's involvement and contribution in furthering the relationship between India and Kenya and had the privilege of honouring her with the Jawaharlal Nehru Award for International Understanding for the year 2005. She concludes her Nobel Lecture on December 10, 2004 like this: I quote, "As I conclude I reflect on my childhood experience when I would visit a stream next to our home to fetch water for my mother. I would drink water straight from the stream? I saw thousands of tadpoles: black, energetic and wriggling through the clear water against the background of the brown earth. This is the world I inherited from my parents?". Prof. Mathaai would like all of us to preserve this inheritance.

Birth of Creativity in a difficult situation:

Mario Capecchi had a difficult and challenging childhood. For nearly four years, Capecchi lived with his mother in a chalet in the Italian Alps. When World War II

broke out, his mother, along with other Bohemians, was sent to Dachau as a political prisoner. Anticipating her arrest by the Gestapo, she had sold all her possessions and given the money to friends to help raise her son on their farm. In the farm, he had to grow own wheat, harvest; take it to miller to be ground. Then, the money which his mother left for him ran out and at the age of four and half years, he started sometimes living in the streets, sometimes joining gangs of other homeless children, sometimes living in orphanages and most of the time hungry. He spent the last year in the city of Reggio Emilia, hospitalized for malnutrition where his mother found him on his ninth birthday after a year of searching. Within weeks, the Capecchi and his mother sailed to America to join his uncle and aunt.

He started his 3rd grade schooling afresh over there and started his education, interested in sports, studied political science. But he didn't find interesting and changed into science, became a mathematics graduate in 1961 with a double major in Physics and Chemistry. Although he really liked Physics, its elegance and simplicity, he switched to molecular biology in graduate school, on the advice of James D Watson, who advised him that he should not be bothered about small things, since such pursuits are likely to produce only small answers.

His objective was to do gene targeting. The experiments started in 1980 and by 1984, Capecchi had clear success. Three years later, he applied the technology to mice. In 1989, he developed the first mice with targeted mutations. The technology created by Doctor Capecchi allows researchers to create specific gene mutations anywhere they choose in the genetic code of a mouse. By manipulating gene sequences in this way, researchers are able to mimic human disease conditions on animal subjects. What the research of Mario Capecchi means for human health is nothing short of amazing, his work with mice could lead to cures for Alzheimer's disease or even Cancer. The innovations in genetics that Mario Capecchi achieved won him the Nobel Prize in 2007. Noble laureate Capecchi life indeed reveals: -

When you wish upon a star, Makes no difference who you are?

With this background of unique traits of great minds, dear friends, I am sure you will think big. Now it is time to have a great dream in life, dream transforms into thoughts and thoughts result into action. In the environment of BITS, I was thinking when you complete your education, you have to take different assignments in different institutions in the country. Many a times you have to take the leadership position also after acquiring experience. At this point of time, I would like to share with you, the technological and leadership challenges to be taken up by you during the next two decades.

Technological challenges:

Five technological challenges await you when you enter in your professional career.

Information and Communication Technology: India has to become ?Knowledge

System Powerhouse? instead of software powerhouse. Also to achieve global operations, we have to consider introduction of virtual platforms for development of knowledge products based on national experience in engineering design of multiple systems leading to a business volume of US\$200 billion by 2012 from the present business volume of US\$60 billion.

Energy: As the President of India, when I addressed to the nation in 2005, I have set a goal of realizing Energy Independence (coming out of fossil fuel) by the year 2030. When our population may touch 1.4 billion people, demand from power sector will increase from the existing 130,000 MW to about 400,000 MW. This assumes an energy growth rate of 5% per annum. Electric power generation in India now accesses four basic energy sources: Fossil fuels such as oil, natural gas and coal; Hydroelectricity; Nuclear power; and Renewable energy sources such as bio-fuels, solar, biomass, wind and ocean. One of the important research areas will be to increase the efficiency of photovoltaic cells from the existing 15% to 50% within the next three years and make the commercial version available in five years time.

Automobile industry: Future Automotive systems will have characteristics such as Improvement in Combustion Efficiency, Improvement in Diesel Engines, systems using alternate Fuels and Hydrogen powered fuel cells, systems operated using CNT based solar cells for higher efficiency and design and development of robotic cars which obey traffic laws, merge into moving traffic, avoid obstacles, and negotiate intersections. The robotic technology is indeed taking shape and we may see in this decade Robotic Cars in many parts of the world. We have to aspire to work towards increasing the business volume of Indian automobile industry to US\$200 billion by 2016 (with an export component of at least US \$ 50 billion) from the present US\$45 billion.

Aerospace field: In the area of space, India has to work for Low cost access to space bringing the cost per kg from the present \$20,000 per orbital kg to \$2,000. This will eventually lead India to take part in many mass missions for earth applications and interplanetary exploration for industrial base and second habitat. India has to work for 70 seater aircraft which should be so designed that with only change in fuselage length should be able to vary the passenger capacity to 50 or 90. With the technology available through various programmes, design development and leading to production of 70 seater passenger aircraft before 2020 is possible. This will lead to a business volume of US\$15 billion.

PURA Mission: PURA (Providing Urban Amenities in Rural Areas) envisages economic empowerment to a cluster of villages through the provision of physical connectivity, electronic connectivity and knowledge connectivity leading to economic connectivity. The theme of PURA, apart from concentrating on reinforcing agriculture, will emphasize on agro processing, development of Rural Craftsmanship, dairy, fishing, silk production, so that the non-farm revenue for the rural sector is enhanced, based on the core competence of the region. Also the rural economy will be driven by renewable energy. In this approach, the aim is to make sustainable development using the core competence of the rural sector. These PURA will be technology driven. The entire country will have 7000 PURAs (Providing Urban Amenities in Rural Areas) encompassing over 600,000 villages. Young friends, you prepare yourselves for chasing these six challenges in your professional life.

Conclusion:

For success in all these missions, it is essential to have creative leaders. Creative leadership means exercising the vision to change the traditional role from the commander to the coach, manager to mentor, from director to delegator and from one who demands respect to one who facilitates self-respect. For a prosperous and developed India, the important thrust will be on the generation of a number of creative leaders from our educational institution like Birla Institute of Technology and Sciences. I would like to share with you an inspiring message from Maharishi Patanjali in Yoga Sutra:

"When you are inspired by some great purpose, some extraordinary project, all your thoughts break their bounds, your mind transcends limitations, your consciousness expands in every direction, you will find yourself in a new great and wonderful world. Dormant forces, faculties and talents become alive and you discover yourself to be a greater person by far than you ever dreamed yourself to be."

With these words, I inaugurate the QUARK? 2009. My greetings to all the members of BITS. My best wishes to all of you in your educational mission.

May God Bless you.

Eight point Oath for Engineering Students

1. Engineering and Technology is a life time mission. I will work, work and work and succeed.
2. Wherever I am, a thought will always come to my mind. That is what process or product I can innovate, invent or discover.
3. By the use of technology, I will make a change for the good of the society.
4. I will always remember that? Let not my winged days, be spent in vain?
5. I realize I have to set a great technological goal that will lead me to think high, work and persevere to realize the goal.
6. My greatest friends will be great scientific/technological minds, good teachers and good books.
7. I firmly believe that no problem can defeat me; I will become the captain of the problem, defeat the problem and succeed.
8. I will apply my knowledge in engineering and technology for the societal transformation of my region. My National Flag flies in my heart and I will bring glory to my nation.