

Address and interaction with the  
Students of Medical & Engineering  
Hassan  
29 October 2010

**Convergence of Technologies for a  
better nation and humanity**

*Medicine with compassion, and societal  
centric technology are the need of the nation.*

I am delighted to address and interact with the Students of Engineering and Medical from a beautiful city of Hassan (Karnataka). The city of Hassan occupies a beautiful place in the history of India dating back to the 11<sup>th</sup> century. It is known as the temple – architectural capital of Karnataka and is well known as a religious and tourist place. My greetings to all of you. Today, when I find young engineers on one hand and young future doctors on the other hand, a thought comes to me – how can different streams of technology and medical sciences converge towards the benefit of the nation and development of humanity. Hence, the topic I would like to discuss with you today is, **“Convergence of Technologies for a better nation and humanity”**.

**The knowledge society in 21<sup>st</sup> century**

Let me first discuss with all of you, the profile of knowledge society which you are going to experience in the country next few decades in this century. The world in the 21<sup>st</sup>

---

Dr. APJ Abdul Kalam  
[www.abdulkalam.com](http://www.abdulkalam.com)

century will be a knowledge based society with multiple opportunities. I was reading a book, “Empires of the Mind” by Denis Waitley. This book gives, what type of the new world which we are facing now? What was yesterday and what is today. I have modified certain points of the author to suit our conditions. I have also added a third line which relates to action of education system.

It specially says that ***“what worked yesterday, won’t work today”***.

1. Yesterday – natural resources defined power  
Today - knowledge is power  
**Education system will be a powerhouse for knowledge**
2. Yesterday - Hierarchy was the model  
Today- synergy is the mandate  
**Education system will be enabler of intersection of multiple faculties towards mission goals**
3. Yesterday – leaders commanded and controlled  
Today – leaders empower and coach  
**Potential Leaders will be empowered through exposure to the needs of sustainable development**
4. Yesterday - shareholders came first  
Today – customers come first  
**Education should inculcate sensitivity to “customer” needs**
5. Yesterday - employees took order  
Today – teams make decision  
**Education system will inject team spirit**
6. Yesterday - seniority signified status

- Today – creativity drive status  
**Education system is the breeding environment for creativity**
7. Yesterday – production determined availability  
Today – Competitiveness is the key  
**Competitiveness is powered by research and Education system has to have the motto of “teaching-research-teaching”**
8. Yesterday - value was extra  
Today – value is everything  
**Objective Value judgment to be introduced in education**
9. Yesterday – everyone was a competitor  
Today – everyone is a customer  
**Educated customer is also a part of the Education system**
10. Yesterday - profits were earned through expediency  
Today – Work with integrity and succeed with integrity.  
**Education with value system is the need of the hour**

In the knowledge economy the objective of a society changes from fulfilling the basic needs of development to that of empowerment. The education system will be promoted by creative, interactive self learning – formal and informal education with focus on values, merit and quality. The workers instead of being skilled or semi-skilled will be knowledgeable, self-empowered and flexibly skilled. The type of work instead of being structured and hardware driven will be less structured and software driven. Management style will

emphasize more on delegation rather than giving command. Impact on environment and ecology will be strikingly less compared to industrial economy. Finally, the economy will mostly be driven by knowledge and knowledge driven institutions and industries. The emphasis in knowledge society will be on sustainable development.

Friends, the basis of the convergence of technology emanates from focus on research in the education system. Let me now discuss research teaching research.

### **Research Teaching Research**

Good teaching emanates from Research. The teachers' love for research and their experience in research are vital for the growth of the institution. Any University 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 the research.

Technology is the non-linear tool available to humanity, which can affect fundamental changes in the ground rules of economic competitiveness. Science is linked to technology through applications. Technology is linked to economy and environment through manufacture of knowledge products. Economy and environment are linked to technology, which promotes prosperity to the society. We have to use innovation to generate high value added products for becoming a global player. The foundation of academic research is creativity.

Now let me talk about a great healthcares giver whose mission has been giving vision to the lives of millions.

### **Reaching the Unreached**

In the present circumstances and environment, it was inspiring to see, how a MBBS doctor has put all his dreams in mainstreaming the tribal citizens of Karnataka for the last 25 years through Vivekananda Girijana Kalyan Kendra (VGKK), at BR Hills. When I visited BR Hills in 1998 and subsequently in 2006, I could see substantial new developments in that area. I could see that “New Tribal Hospital”, Roads and education environment and above all the earning capacity of the tribal citizens have been increased with the technology resource centre as a base. Dr. H. Sudarshan, is the inspiring architect of this societal transformation. The mission which he has started has spread to many parts of the country including the Andaman and Nicobar Islands and Arunchal Pradesh. Dr. Sudarshan and his team have been selecting difficult regions and making a difference to the people of that region by their own way of life which was started in a small hut. Country needs thousands of Dr. Sudarshans for providing healthcare to our rural citizens. I am sure some of you may emulate Dr. Sudarshan in this noble mission.

### **Lead Kindly Light**

I have known Late Dr. G. Venkatasamy for over three decades. He is known for his silent contribution and bringing

light to thousands of people. All his life, he has worked for total elimination of avoidable blindness. He established the first Aravind Hospital in the year 1976. With the establishment of Aravind Hospital, he brought the best of technology and management in eye care system. He has created many leaders in the field, who are spread in various parts of the world. Whichever eye hospital I visited in India, I met doctors who were trained by Dr. G Venkatasamy. It was amazing to see how even in his eighties he was radiating enthusiasm and perseverance for realizing his vision.

Dr Venkatswamy championed the community ophthalmology service in Tamilnadu and surrounding region. This was at a time when there was tremendous amount of cataract back log, and there were not enough specialists. Using a systematic approach to mass screening and surgery he infused both science and discipline to mass surgical eye camp. The mass movement for treatment of cataract shifted from improvised operating rooms to hospital operating room facilities. Now, Aravind Eye Care System has successfully integrated their core competence of community ophthalmology with modern medical treatment and research.

Dr Venkataswamy implemented his principle that the Aravind hospital must provide services to reach rich and poor alike, yet the eye care facility must be financially self-supporting. The entire Aravind Eye Care System is conducting

on an average 800 eye surgeries per day and annually treat over 2.5 million patients. They are providing for every 30 paid patients, free treatment for 70 patients who cannot afford. This principle is achieved through high quality, large volume care and a well-organized system.

Aravind has grown into five hospitals with nearly 3,600 beds and 26 vision centres spread in different parts of Tamilnadu particularly in rural areas. The important aspect of Aravind system is that the productivity per ophthalmic specialists is 5 times that of national productivity. Aravind has contributed in a big way to reduce the avoidable blindness in the country. The world has recognized Aravind's contribution. I was happy to see many researchers from different parts of the world are partners in the Venkataswamy Research Centre at Madurai. The life of Dr. Venkataswamy gives the message to all of us, how commitment to a vision can make missions happen.

Now, I would like to present my experience of learning system design, system integration and system management while I was a student.

### **Learning integrated system design**

While I was studying aeronautical engineering in MIT, Chennai, (1954-57) during the third year of my course, I was assigned a project to design a low-level attack aircraft together with six other colleagues. I was given the responsibility of

system design and system integration by integrating the team members. Also, I was responsible for aerodynamic and structural design of the project. The other five of my team took up the design of propulsion, control, guidance, avionics and instrumentation of the aircraft. My design teacher Prof. Srinivasan, the then Director of MIT, was our guide. He reviewed the project and declared my work to be gloomy and disappointing. He didn't lend an ear to my difficulties in bringing together data base from multiple designers. I asked for a month's time to complete the task, since I had to get the inputs from five of my colleagues without which I cannot complete the system design. Prof. Srinivasan told me "Look, young man, today is Friday afternoon. I give you three days time. If by Monday morning I don't get the configuration design, your scholarship will be stopped." I had a jolt in my life, as scholarship was my lifeline, without which I cannot continue with my studies. There was no other way out but to finish the task. My team felt the need for working together round the clock. We didn't sleep that night, working on the drawing board skipping our dinner. On Saturday, I took just an hour's break. On Sunday morning, I was near completion, when I felt someone's presence in my laboratory. It was Prof. Srinivasan studying my progress. After looking at my work, he patted and hugged me affectionately. He had words of appreciation: *"I knew I was putting you under stress and*

*asking you to meet a difficult deadline. You have done great job in system design”.*

Through this review mechanism Prof Srinivasan, really injected the necessity of understanding the value of time by each team member and brought out engineering education has to lead system design, system integration and system management. I realized that if something is at stake, the human minds get ignited and the working capacity gets enhanced manifold. That’s what exactly happened. This is one of the techniques of building talent.

The message is that young in the organization, whatever is their specialization, be trained in system design, system integration and system management which will prepare them for competitiveness wherever they take-up work in developing new products, innovation and undertaking higher organizational responsibilities. Teacher has to be a coach like Prof. Srinivasan.

Now let me discuss about 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 that may results revolution in healthcare system. 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 and electronics leading to nano computing systems. 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.

### **Joy of removing the pain**

An important event I would like to share with you is about the fitment of FRO (Floor Reaction Orthosis) caliber to a polio affected child which shows how engineering and medical sciences can converge to alleviate the pain of human kind.

During my visit to one of the hospitals in Hyderabad, I found many children were struggling to walk with an artificial limb weighing over 4 kgs. At the request of Prof. Prasad of NIMS, Head of orthopedic department at that time, I asked my AGNI friends why we cannot use the composite material used for AGNI heat shield for fabricating FROs for polio affected patients. They immediately said it is possible. We worked on this project for sometime and came up with a FRO for the child weighing around 400 gms in place of 4 kg. Exactly, 1/10<sup>th</sup> of the weight which the child was carrying. The doctors helped us to fit the new light weight FRO on children and the children started walking and running around. Their parents were also present. Tears rolled down on all of them through the joy of seeing their daughters and sons running with light caliper. With the light weight device provided by the hospital they could run, ride a bicycle and do all sorts of things which they had been denied for a long time. The removal of the pain and the freedom attained by the child gave me a state of bliss which I never experienced earlier.

Friends, let me now discuss about the emergence of borderless world.

### **Emergence of new world order**

When I was traveling in an Aircraft in the United States, I was told that much of its controls were software driven and most probably developed in India. When I presented my credit card, I was told that it was being processed in the backend

server located in Mauritius. When I walked into multi-national software development centre, Bangalore, I was fascinated to find that it truly presented a multicultural environment. A software developer from china working under a project leader from Korea working with a software engineer from India and a hardware architect from the US and the communication expert from Germany where all working together to solve the banking problem in Australia.

What message do we get from these events and many such occurrences in the past decades? Do they not indicate a new world order emerging? Technology has made world to come together. For the past few months, I had several opportunities to meet with world specialists, economists and leaders in India, Israel, UK, USA and other countries. The outcome of the discussions led to interesting possibilities for taking education forward in a “borderless world”.

Now I would like to describe my visualization of the distinctive profile of India by 2020.

### **Distinctive Profile of India by 2020**

1. A Nation where the rural and urban divide has reduced to a thin line.
2. A Nation where there is an equitable distribution and adequate access to energy and quality water.
3. A Nation where agriculture, industry and service sector work together in symphony.

4. A Nation where education with value system is not denied to any meritorious candidates because of societal or economic discrimination.
5. A Nation, which is the best destination for the most talented scholars, scientists, and investors.
6. A Nation where the best of health care is available to all.
7. A Nation where the governance is responsive, transparent and corruption free.
8. A Nation where poverty has been totally eradicated, illiteracy removed and crimes against women and children are absent and none in the society feels alienated.
9. A Nation that is prosperous, healthy, secure, devoid of terrorism, peaceful and happy and continues with a sustainable growth path.
10. A Nation that is one of the best places to live in and is proud of its leadership.

### **Integrated Action for developed India**

To achieve the distinctive profile of India, we have the mission of transforming India into a developed nation. We have identified five areas where India has a core competence for integrated action: (1) Agriculture and food processing (2) Education and Healthcare (3) Information and Communication Technology (4) Reliable and Quality Electric power, Surface

transport and Infrastructure for all parts of the country and (5) Self-reliance in critical technologies. These five areas are closely inter-related and in a coordinated way, leading to food, economic and national security.

### **India's future missions**

Dear young friends, I would like to present, what type of opportunities will be available to the professional graduates in the coming years.

1. **Agriculture and Food processing:** Increase the productivity into 4 times and concentrate on Food processing and marketing. Annual investment is around \$20 billion.
2. **Infrastructure:** Apart from rural and urban infrastructure, one hundred million homes have to be built with energy efficient and water efficient systems. Annual investment in this sector will be around \$80 billion per year.
3. **Automobile:** The export has to be 50% of our output. We are expecting a business volume of \$200 billion by 2016 from the existing \$45 billion.
4. **Ship Building:** High Dead weight ships have to be built in the country. This will have a business volume of over \$50 billion.
5. **Information and Communication technology:** We have to keep pace with the growth inspite of global recession

by applying ICT for India. We are expecting to reach business volume of \$200 billion per year by 2012.

6. **Pharma and healthcare:** India must account for atleast 25% of generic drug produced world over. Pharma vision aims to reach the business volume of \$50 billion by 2016.
7. **Aerospace:** 70 seater passenger jet aircraft has to be designed and developed involving 20 billion dollars of market for the next 10 to 15 years.
8. **Rail-vision:** Railway length has to be increased, metros have to come for faster transportation and multi-level station systems have to become operational to reduce city crowding, average speed of the train has to be doubled. Average annual investment will be over \$25 billion.
9. **Energy Independence:** By 2030, we should attain energy independence through renewable energy sources such as solar and wind; nuclear and bio-fuels for transportation. Average annual investment will be over \$30 billion.

Friends as all of you would soon be entering into professional careers, let me highlight the importance of time management.

**Let not thy winged days, be spent in vain**

As you all know, the earth rotates on its own axis once in a day having 24 hours or 1440 minutes or 86400 seconds.

Earth itself orbits around the sun. It takes nearly one year for an orbit. With the completion of one rotation of earth around the sun, your age and my age is added by one year as you are living on planet earth. Seconds fly, minutes fly, hours fly, days fly and years fly. We have no control over time. The only thing that we can do is, while the time flies, we can navigate the time. Friends will you navigate the time? “Let not thy winged days, be spent in vain”.

### **Conclusion**

Since I am in the midst of young future engineers and doctors, I would like to put-forth a thought: ***What would you like to be remembered for? You have to evolve yourself and shape your life. You should write it on a page. That page may be a very important page in the book of human history. And you will be remembered for creating that one page in the history of the nation – whether that page is the page of evolution of a new technological systems, the page of innovation in a way of working, or the page of creating action oriented missions for the people or the page of triumphing over diseases which have afflicted humanity for ages, or the page of contributing towards inclusive growth of the nation in a time bound manner.*** You can write your views on this question and mail it to me [apj@abdulkalam.com](mailto:apj@abdulkalam.com) .

My best wishes to all of you success in all your missions.

May God bless you.

Now I would like to administer an oath for the students.

### **Oath for medical professionals**

1. I love my medical profession a noble mission.
2. I will follow the motto “Let my care, remove the pain and bring smiles”.
3. I will always radiate cheer to give confidence to patients and their families.
4. I will be a life long learner, I will practice what I learn and I will train my team to be competent.
5. I will deliver quality care with high standards irrespective of whom I am treating.
6. I will not introduce any diagnostic pain.
7. I will work with integrity and succeed with integrity.

### **Oath for the Students**

- 1 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 I will always remember that “Let not my winged days, be spent in vain”.
- 4 I realize I have to set a great technological goal that will lead me to think high, work and persevere to realize the goal.

- 5 My greatest friends will be great scientific -technological minds, good teachers, good books and good internal environment.
- 6 I firmly believe that no problem can defeat me; I will become the captain of the problem, defeat the problem and succeed.
- 7 I will work and work for removing the problems faced by planet earth in the areas of water, energy, habitat, waste management and environment through the application of science and technology.
- 8 I realize, I am as young as my faith, as old as my doubt; As young as my self-confidence, as young as my fear; As young as my hope and as old as my despair. I will develop faith, self-confidence and hope.
- 9 My National Flag flies in my heart and I will bring glory to my nation.