



## FOUNDATION DAY ADDRESS

Raja Ramanna Centre for Advanced Technology, Indore  
Monday, February 20, 2006

By  
Prof. S. K. Joshi\*

Dr. V. C. Sahni, Director, RRCAT, Dr.P.D.Gupta, Head, Laser Plasma Division, Sri S.Kotaiah, Project Manager, Indus-2, all the Scientists, technical and other staff of RRCAT and friends.

I consider it a great privilege to have been asked by Dr.V.C.Sahni, Director of the Centre to give this Foundation Day Address. Grateful thanks to you Sahni Saheb.

I am happy to be here for more reasons than one. It is an opportunity to be with you on this important day the Foundation Day. On this day we introspect look back on what we did during the year gone by, and more important we set goals for the Centre for the coming year. It is a pleasure to share your enthusiasm and celebrations on this day.

I am specially happy that this occasion allows me to pay my homage to Dr.Raja Ramanna, after whom this centre was named last December. Dr. Ramanna was my mentor and he indirectly played a great role in shaping my career and he always encouraged me to do better. This lecture is my humble tribute to a great visionary and a natural leader of scientists.

My only weak point is that I am now 71 years old. You know when Rayleigh was 67, his son asked him what he thought about the famous remark by Thomas Huxley that a man of 60 in science does more harm than good. Rayleigh thought about it and said, "Well I don't see why that should be so, provided you do what you understand, and do not contradict young people". Sahni Saheb thought that I have great faith in young people and my address would encourage them. I shall attempt to meet his expectations.

Dr. Sahni just now presented to us the scientific achievements of the Centre during the previous year. These achievements are impressive. My congratulations to all of you for what has been accomplished during the past year. One would like to specially compliment the Indus-2 team, for putting together the storage ring, along with the transfer line and their success in storing the beam. I am not mentioning other notable achievements in the area of lasers, not because they are unimportant, but I would like to focus on Indus-2; whole nation is looking forward to its operationalisation with great eagerness.

#### Department of Atomic Energy makes India feel proud

We owe a debt of gratitude to Dr.Homi Bhabha for conceiving the Atomic Energy Programme in India and making it take roots and thrive. Bhabha had full faith in Indian scientists. That faith and his leadership made all scientists and engineers hold their heads high and say, "we can do it and we will do it". Bhabha laid a strong foundation of a self-reliant atomic energy programme for our country.

Energy security is a matter of vital importance particularly in the context of accelerating pace of our economic growth. Our country has to succeed in instituting a mix of energy resources in which nuclear energy is an important component in order to ensure energy security. India's pace of economic growth can only be sustained by generating more electricity from these resources.

Today our country is talking of 10% growth, a superpower status and rising entrepreneurial competence. Infrastructural bottlenecks are being removed. Many sectors of economy like IT, pharmaceutical, telecom and automobiles

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Dr. Joshi was elected Fellow of the Indian National Science Academy in 1974. He was the Secretary of the Academy during 1983-86 and its Foreign Secretary during 1989-92. He was elected President of the INSA in 1993. He is Fellow, Indian Academy of Sciences since 1974 and was Vice President from 1989 to 1991. Prof. Joshi was President of Indian Physics Association during 1989-90. He is President, Materials Research Society of India. Prof. Joshi is a Fellow of the Third World Academy of Sciences; and a Foreign Member of the Russian Academy of Sciences.

He won the Watmull Memorial Prize for 1965, Shanti Swaroop Bhatnagar Prize for Physical Sciences in 1972; CSIR Silver Jubilee Award in 1973, and Meghnad Saha Award for Research in Theoretical Sciences in 1974. He also won Dr. K.S. Krishnan Memorial Lectureship of INSA in 1987, and FICCI Award in Physical Sciences for 1990; Dr. Mahendra Lal Sircar Prize by IACS Calcutta for 1989 in 1994. He was awarded Padma Shri in 1991; Goyal Prize in Physics by Goyal Foundation in 1993; D.Sc. (honoris causa) Kumaun University in 1994; and Indira Gandhi Priyadarshini Award in 1994.

Prof. Joshi's major research contributions span over a wide variety of topics in solid state theory and in atomic and molecular collisions. His early researches were concerned mainly with study of photons in metals and insulators. Dr. Joshi did research work in area of electronic states in disordered systems and theory of electron correlation in narrow band solids. He has also worked on surface states and surface segregation. Dr. Joshi has conducted studies on excitation and ionization processes in atoms ions and molecules due to the impact of electrons and protons. The current research interests of Dr. Joshi lie in high temperature superconductivity and heavy fermion systems. Prof. Joshi has supervised the Ph.D. theses of 18 scholars and has published more than 175 research papers. On retirement as DG, CSIR Prof. Joshi has been awarded the Sarabhai Research Professorship in Physics.



have become world class. India is emerging as the number one knowledge process destination of the world. I am told in the recent Davos Economic Forum every body was talking about Indian brain-power and India as an investment destination.

The Department of Atomic Energy through its R&D laboratories is uniquely placed to develop technologies required for nuclear power specially based on utilization of raw material thorium available in plenty in India. DAE's contributions to scientific publications in areas of pressurized heavy water reactors, fast breeder reactors, and thorium utilization are substantial. Fast breeder reactor technology is of crucial importance in enhancing our nuclear power capacity. In long term, India has the potential of becoming a world leader in this technology.

India is a responsible nuclear power. India has never been a source of proliferation of sensitive and dual use technologies. Indo-US nuclear co-operation envisaged in July 2005 joint statement is currently a hot topic. If one looks at US-China nuclear co-operation agreement, one finds that US advanced its diplomatic, security, and economic interests in China and China saw to it that no constraints are put on China's nuclear plan because of US non-proliferation policies. Our negotiators should be able to negotiate in such a way that the high technology competence of our scientists is not constrained, specially in areas like fast breeder reactor technology.

Let me change the topic to another area of concern.

## **Decline in Research in India**

It is somewhat strange that when our economy is growing so well our strength in scientific research is on the decline. In a study published in Nature in 2004, David King, then Chief of the office of S&T UK found that India is 30<sup>th</sup> in the list of 31 nations he had taken for study on the basis of normalized citation rate per paper. Iran is the last. What is most worrisome to Indian scenario is the weakening of the university system in terms of scientific research and teaching put together. Unless this is corrected, things would not improve. In addition to declining interest in science amongst students, there is lack of faculty with track record of research. The problem requires drastic reforms. When there is so much optimism about India's economic potential it is necessary to have similar aspirations for its universities: the breeding grounds of talent, and the natural habitat for basic research. In the long term the future of our country would depend on the health of our educational institutions.

The next generation, which is to provide scientists, engineers, entrepreneurs, managers, businessmen of future is educated in our universities. They must be taught by teachers who know what science is, what research is, who have experienced the sweet feeling of understanding a problem and its answer. Alas! this may not happen except for lucky few studying in our very few good universities. Keeping this in mind, as well as to cater to the manpower needs of the DAE

constituent units, the most recent initiative of the Department is to set up the Homi Bhabha National Institute as a Deemed to be University. This will be a unique university which will utilise the scientific strength of DAE constituent units and autonomous research institutes supported by DAE, to provide world-class training to our students.

## **Economic Sense of Scientific Research**

When we are witnessing India's tremendous economic growth, one ponders how we can make an economic sense of the science that we are doing. Science can make an economic sense only when we awaken entrepreneur in a scientist and also scientist in an entrepreneur. For us to compete effectively with the rest of the world the entrepreneurship has to grow and keep growing. Our businesses have to be open to risks, open to investment and open to new alliances. Risk taking is the name of the game. Businesses have to seek new ideas sprouting here and there specially in places like RRCAT. India needs entrepreneurs to capitalize on new opportunities, to create wealth and new jobs. A recent report says that in next 10 years, there would be about 15 crore Indians searching for jobs it is entrepreneurs who will mostly create these jobs because the traditional employers like government and large companies may find it difficult to sustain the present level of employment in future.

India today in a position to compete with other countries, because we have started seeing the emergence of innovation driven businesses producing innovative products and services. Indian companies have just started to realize that we can use our technical and scientific manpower to create products/services which can compete with the best in the world. As one of the youngest countries in the world, with more than half the country's population still to reach the age of 25, we have the unique opportunity to ride the wave of innovation, the spirit of innovation is the spirit of being the best.

We should envision India's future with great optimism and hope. The twenty first century will belong to India. I believe India will be counted among top economic powers of the world by 2025, and India will be the intellectual capital of the world. We would ultimately become not only a nation leading in science through resurgence of research in India's R&D centres, research labs and universities, but we would also have entrepreneurs to make economic sense of the science.

## **Intellectual Property Management**

In institutions like RRCAT we must learn to pay attention to management of our intellectual property be it patents, copyrights, design etc. The skills in filing, reading and exploiting patents are necessary. Today our ability to read and write patents is generally poor. Neither can we properly protect our inventions nor do we understand the implications of patents granted to our competitors. We may have a good invention, we can not effectively protect it by patents because many of the patents written by us could be easily circumvented by these who have mastered this art. Today we are No.22 in the world in



patents and Korea is No.8. There is no reason why India can not be in top 5 patent filers in the world by 2015. For this

- i. We need to strengthen awareness about patents.
- ii. We should institutionalize the skill in patent filing.
- iii. We have to definitely modernize Indian patenting system.
- iv. We must provide financial support and facilitation services to SME's and less endowed educational institutions for filing patents for sometime in future.

### Team spirit

At this centre you are part of a team, and your job is part of major project. It is conducive and motivating if you have a view of what the whole project is. I am here reminded of a story of two masons working on a construction. When they were asked what they were doing, one of them said that he was building a wall, the other said that he was building a temple. The mason who had a larger picture and purpose in mind did have a qualitatively different approach to his work, with a higher degree of dedication and motivation. If you have an overall view of the project, beyond your specific job, you would contribute better.

The immediate task and the highest priority for RRCAT is to make Indus-2 functional as early as possible. I urge each one of you to join hands scientists, engineers, support staff and administration and finance. In institutions like CSIR laboratories I know of, I can compare the administration with the hypothetical element "administratium". This element has no electron and no protons, therefore cannot get charged under any conditions! It has 1 neutron, 10 associate neutrons and numerous assistant neutrons. Such an administratium is completely inert. I am sure RRCAT administration is an exception to this general picture, and the administration here considers itself a part of the team, and enthusiastically supports and facilitates the progress of the Indus-2 and other projects.

### Are we ready to make Indus-2 functional during the coming year?

Dr.Sahni described to us the remarkable progress that we have made with Indus-2. This progress is satisfying, but the trouble begins when we start succeeding. People expect us to do even better. Scientific community is eagerly looking forward to you to provide them the synchrotron light source. Many of them complain that they are not able to do good work because they do not have access to an x-ray synchrotron source. We have to keep these feelings in mind and get ready for the dramatic leap forward.

Kotaiah, you all have to sit together, discuss, argue, and decide with your Director the minimum time you would take to make Indus-2 functional. Once you have decided on that goal, all of you have to work relentlessly, with total commitment and no compromises. With so many bright, resourceful, hardworking people around, we should be able to achieve the goal. To some this goal may look like an impossible dream, but

they do not realize what they are capable of achieving. We sometimes persistently think small or are victims of a defeatist attitude.

I would like you to hear what C.V.Raman said more than 60 years back "I would like to tell you not to lose hope and courage. Success can come to you by courageous devotion to task lying in front of you, and there is nothing worthy in this world which can come without the sweat of our brow. I can assert without fear of contradiction that the quality of an Indian mind is equal to the quality of any Teutonic, Nordic or Anglo-Saxon mind. What we lack perhaps is the courage, what we lack is perhaps the driving force which takes one anywhere. We have, I think developed an inferiority complex. I think what is needed in India today is the destruction of that defeatist spirit. We need a spirit of victory, a spirit that will carry us to our rightful place under the sun, a spirit which will recognize that we, as inheritors of a proud civilization are entitled to our rightful place on this planet. If that indomitable spirit were to arise, nothing can hold us from achieving our rightful destiny".

That indomitable spirit is visible in IT, pharma, automobile sectors of Industry was obviously seen in what Dhoni and Yuvraj did in Cricket in Karachi yesterday.

### Pursuit of Excellence

Whatever may be our task, we need to excel and be utterly professional. Excellence attracts excellence. If you work with single minded devotion, you create an environment of dedication which propels people around you to do better. What is essential is that we work steadfastly towards the goal we have set for ourselves with enthusiasm and passion. This centre has to create an environment where every one tries to excel in whatever he is doing.

The path to excellence is strewn with difficulties. Many those whose names inspire us fought against most cruel adversities. Louis Pasteur, son of a tanner, left semiparalysed by a stroke at the age of 46 years, continued to advance the frontiers of biology till the ripe old age of 73. Each one of his contributions to fields as diverse as fermentation, storage and preservation of beer, contagious disease of silkworm, pasteurization of milk, infective diseases of men and animals including development of vaccine against rabies, had an unmistakable mark of excellence. Galileo, 70 years of age and going blind, convicted by inquisition and sentenced to house arrest for remainder of life, persisted with his studies of mechanics. A living legend of our time Stephen Hawking complete physical cripple quadriplegic, without audible voice totally dependent on sophisticated electronic gadgets and external assistance continues to produce the most outstanding work in Cosmology even today.

The greatest scientific deed of Madam Curie proving the existence of radioactive elements and isolating them owes its accomplishment not merely to bold intention, but to a devotion and tenacity in execution under great hardships and



handicaps. This excellence does not come easy. Baptism by Fire is the surest way to excellence.

## Concluding Remarks

It is a pleasure for me to be with you when you are embarking on your projects with a new resolve on this foundation day. The coming year is going to be full of challenges, full of difficulties and obstacles, and it would be good to share a few lessons which I learnt in my life. May be this will be of some use to you.

1. Learn to lose : When you lose, do not lose the lesson. Thomas Elva Edison used to say “I have not failed, I have just found 10,000 ways that won't work. Failure “is in itself an educator”. An experiment that does not lead to expected results will nevertheless provide valuable information and possible path to new phenomena or engineering applications.
2. Have an enduring faith in yourself because then you would be having enduring faith in others.
3. Strive for Excellence. We are what we repeatedly do. Make excellence a habit.
4. The most important task in life is to realize your own potential. It includes your potential for R&D, your potential for meeting challenges, your potential for meeting deadlines, your potential for caring, your potential for sharing, your potential for helping others, and your potential for learning.
5. My experience is that high achievers are individuals with high aspirations. They are accountable and action oriented. High aspirations mean stretching, stretch targets and continuously raise the bar. Stretching targets is success. Accountable means to hold yourself responsible with no excuses for meeting your commitments. Action oriented means being quick, decisive and proactive in anticipating problems.
6. Do not put yourself before the team and the organization. In a team, it is necessary that you care for others. Caring is not about being soft, but in being fair. Caring is about bringing joy in your own life and in the lives of those around you. Encourage younger people, appreciate their contributions. Be a good mentor to them.
7. Continuous learning is lifeline in our job at RRCAT. You have to keep yourself alive by reading journals, books and other sources of knowledge; sharing your knowledge with others. For a scientist it is absolutely necessary to keep reading, attending seminars and discussions and teaching others. Teaching is a good way of learning, it puts a tremendous back pressure on you to read the latest and most authoritative sources. In science you have to learn to learn and keep learning.

New developments in Science and Technology are happening at a breathtaking and spectacular speed. To quote Lewis Carrol in 'Alice through the Looking Glass', “It takes all the running you can do to keep in the same place”.

8. Hard work is the most crucial ingredient of success. Only way you can move ahead of others is by working harder than them. People say that genius is 99% perspiration and 1% inspiration.
9. Don't fear criticism. If you are afraid of criticism, you will not be able to start anything Great or Big.
10. Our body is the basis of all achievements.

शरीरमाद्यं खलु धर्म साधनम्

Therefore take care of your health

युक्ताहार विहारस्य युक्त चेष्टस्य कर्मसु ।  
युक्तस्वप्नावबोधस्य योगो भवति दुःखहा ॥

— गीता

“A practican remains free from stress and strain, if he is moderate in eating and recreation, is temperate in performing action, and is regulated in sleeping and waking. All these promote harmony in body, mind and senses and keep them in good health”.

Don't fill this body with toxins, either through food, drink or toxic emotions. You are really fortunate to live in this sublime and invigorating environments. This adds value and vigour to your life, may be years also. We again remember Raja Ramanna for choosing such a picturesque sight near Sukhniwas lake.

The above are not 10 commandments, but they are distillates of my experiences spread over 50 years, in situations like yours. You may use them the way you wish.

When we march forward from this Foundation Day to the next Foundation Day i.e. February 20, 2007. Keep in mind this hymn from Rigveda.

समानीव आकूति समाना हृदयानिवः ।  
समानमस्तु वो मनो यथा वः सुसहासति ॥

— ऋग्वेद

Common be our desires  
Unified be our hearts.  
United be our intentions  
Perfect be the union amongst us.

Thank You and Good Luck.