90TH INDIAN SCIENCE CONGRESS
RESUME AND RECOMMENDATIONS

The 90th session of Indian Science Congress was held for the eighth time in Bangalore at the Jnana Bharati Campus of the Bangalore University during January 3 – 7, 2003. The focal theme of the Congress was "Frontier Science and Cutting Edge Technologies".

INAUGURATION

THE Congress was inaugurated by the Prime Minister of India, Shri Atal Bihari Vajpayee on 3rd January 2003. The Prime Minister announced and launched the new Science and Technology Policy 2003 and envisioned that science and technology, in all its true spirit, must be embraced to realize the dream of making India a Developed Nation. He mentioned that the Government has recognized that productivity-led growth is the path India has to take in order to attain the ambitious target of 8% GDP growth rate. Appropriate S & T inputs at all levels and in all sectors of the economy are needed to pave this path. The Prime Minister also gave direction to future activities of frontier science and cutting-edge technology and identified the need to connect between science and policy-making in the country; linking R & D to the broader national and global economy through proper investments by the private sector in indigenous R & D, in partnership with our S & T institutions, IITs and universities, so that their products and services become globally competitive ; promotion of traditional technologies – especially those of the grass-root innovators; encouraging and recognizing scientific merit, talent and innovation; attracting the Indian scientific Diaspora to contribute to critical R & D and national development and the need to focus on quality science education in our institutions.

The Prime Minister expressed full optimism about the future of Indian science : "What is needed is pursuit of excellence with single-minded determination and dedication-not just individual excellence but institutional excellence-and making it a sustainable hallmark of the entire S & T establishment. Therefore, the Nation expects you to aim higher, be ambitious and achieve big things".

The Prime Minster also announced the institution of an annual India Science Awards of Rs 25 lakhs for distinguished achievements in science and technology. The Prime Minister gave away 33 ISCA Awards to distinguished and eminent scientists and technologists of the country. The Prime Minster also released the compendium of the 90 Presidential Addresses of ISCA- "Shaping of Indian Science".

Honorable Governor of Karnataka, Shri T.N. Chaturvedi addressed as Guest of Honour and mentioned that science must be brought closer to people and must

be able to address day-to-day problems of society and individuals. He mentioned that India had made spectacular progress in science and technology but the results have to be really felt by people.

Prof. Murli Manohar Joshi, Hon'ble Minister for science & Technology, Government of India, in his address, cautioned not to be entrapped in the consumerist techno-economic dream of the western world, but to root science and technology in our social context. He called for science to be people-friendly and to bring common man closer to science, Prof Murli Manohar Joshi released the "Biodiversity Atlas of India".

Shri SM Krishna, Chief Minister of Karnataka, released the proceedings of the "University Meet", and mentioned that after the Information Technology revolution, it is now time for science and technology to reach out to people in remote areas. He called for political entrepreneurship where experimentation is encouraged and good ideas replicated.

Shri Ananth Kumar, Honorable Minister for Urban Development, released the Procedings of the Plenary Sessions of the 90th ISC – "Frontier science and Cutting-Edge Technologies".

Hon'ble Smt. Vasundhara Raje, Minister of state for space ; Minister of State for S & T. Hon'ble Shri Bachi Sing Rawat and Karnataka State Ministers-Dr G. Parameshwar. Minister for Higher Education, Prof. B.K. Chandrashekar, Minister for Primary and Secondary Education; Shri D.B. Inamdar, Minister for Information Technology and Smt. Nafeeza Fazal, Minister for Science and Technology were also present at the Inauguration.

Dr. K. Kasturirangan, General President, ISCA, in his Presidential Address, outlined the major successes of Indian science and technology and mentioned that the Indian scientific and technological enterprise has become a fundamental condition of modern survival. The dynamic enterprise that S & T represents requires a timely leap to the next stage to meet the challenges of frontier science and cutting edge technologies in service to the nation and its people.

Shri Mukund Rao, Local / Organizing secretary from ISRO proposed the Vote of Thanks.

PRESIDENT OF INDIA'S SUMMIT ADDRESS AT SPACE SUMMIT

The Space Summit was a unique event of the 90th session and was held on January 4,2003. The Summit was inaugurate by Smt. Vasundhara Raje, Hon'ble Minister of Space, Government of India. The Honorable President of India, Dr A.P.J. Abdul Kalam, attended the 90th Indian science Congress on January 4,2003 and delivered the Summit Address at the "Space Summit" and outlined his vision for the global space community for a prosperous, happy and secure

planet Earth. The President emphasized the need for GDP growth of 8% as an important goal for India. In this context, he brought out the role of technology; its relationship with the development and well-being of society and the need to transform Indian society into a knowledge society. The President observed that global terrorism is affecting the overall development of societies – which itself is originating from poverty, illiteracy and unemployment. The President saw a role for energy from space as a growing possibility in the 21st century. The role space can play, in solving the problem of water and the role in integrated and sustainable development, was highlighted. The President envisioned perspective of international cooperation to address common issues including the cost of access to space and cost reduction strategies. He also outlined the need for strategies to combat dangers from Asteroids, debris to space objects etc. The President even suggested the need for a creation of an international space force for safeguarding the assets in space.

The Space Summit, Chaired by Prof M.G.K Menon, also had presentations from the space agency chiefs of France ; Thailand ; World space, USA ; UN OOSA, Vienna ; India ; Malaysia ; NASA, USA ; ESA ; Chinese Space Agency and NOAA, USA. Under the "Space Bridge Demonstration" of the Space Summit, two live demonstrations on Space for Tele-Medicine and Space for Development Communications were organized.

90TH ISC SESSIONS

More than 6200 delegates comprising eminent scientists, technologists, academicians, common citizen's and experts from all over India and abroad participated in the Congress. The 90th session was organized in 6 Plenaries addressing key frontier science and cutting-edge technologies ; 3 Panel Discussions on key technology areas ; 3 Public Forum Sessions for interaction by the public ; 14 parallel sectional Symposia ; a unique Space Summit having heads of more than 12 space agencies of the world ; a University Meet addressing the challenges of university science education in the context of frontier science and cutting-edge technologies ; a special Science for School; Children's session attracting more than 2000 school students and a Leadership Summit (organized in collaboration with Confederation of India Industry) as a Pre-Congress activity. A total of about 800+ papers were presented either as oral or poster papers in the 20 major sessions of the 90th ISC.

SCIENCE FOR SCHOOL CHILDREN SESSION

The Science for school Children session was inaugurated by Dr B.K. Chandrasekhar, Minister for Primary and Secondary Education, Karnataka on January 3, 2003 in the afternoon. The Exhibition of this session was inaugurated by Smt. Nafeeza Fazal, Minister for Science and Technology, Karnataka. The Honorable President of India, Dr. A.P.J. Abdul Kalam interacted with the children in this session on January 4,2003 and addressed them. In a very touching and

motivating manner, the President urged the children to work for a developed India and also to condition their mind to question and enjoy the magic of science.

SCIENCE EXPO-2003 EXHIBITION

The Prime Minister also inaugurated the "Science-Empo-2003; Pride of India" exhibition organized on the occasion by MM Activ, Pune and had the participation of about 125 S & T agencies from the government private and academic sectors. A unique aspect of the Expo was the "Hall of Pride" depicting the life and achievements of India's 2 proud scientis / technologists – Dr Vikram Sarabhai and Mr. Dhirubhai Ambani. The exhibition was open to public and attracted almost 2 lakh people over the 5 days of the Congress. The Honorable President of India, Dr. A.P.J. Abdul Kalam also visited the Science Expo exhibition on January 4,2003.

RECOMMENDATIONS

The delegates of the Congress had extensive deliberations in the various sessions of the Congress and offered valuable inputs and directions – which have been encapsulated in the recommendations of the 90th Congress. These recommendations could be appropriately considered by the various departments / institutions of the Government, private sector and the academia.

S & T POLICY

- The science and Technology Policy – 2003 must be implemented as outlined to build a new and resurgent India that continues to maintain its strong democratic and traditional links and to readily adapt to the rapidly changing world order. An annual review of the S & T policy be conducted to identify specific directions and tasks and the Policy be also regularly updated / modified / re-structured every 5 years to adapt to changing environments.

- The institution of the India Science Award is encouraging and must recognize distinguished and meritorious achievements in science and technology.

ENERGY DEVELOPMENT

- It is essential to define an Energy Policy for the nation that will give enough preparation, planning and induction time for all new sources of energy, to mature the technology and to make them economical. For this, a thorough knowledge and study of the prospects, economics, and long-term environmental concerns due to implementation of various energy related technologies are necessary.

- Considering the dwindling resources of petroleum based fuels it is essential to plan for alternate sources of fuel for transportation. The technology developments in alternate energy sources such as hydrogen, various types of fuel cells, gas-hydrates, methanol, bio fuels, electric operated vehicles need to be thrusted. Appropriate level of assessment of switch over process from conventional fuel to alternate fuels is required to ensure economy, easy availability and public acceptance.

- A systematic programme for the exploration and exploitation of gas hydrates may meet the ever-increasing requirement of energy for country like ours. On the other hand, it can reduce the environmental hazard, if exploited properly.

- It is proposed that a broad based national consultation involving the R & D institutions, industries and the energy utilities be held early to prepare a hydrogen vision and a road map for the next few decades.

- Significant technology development in nuclear fusion has taken place worldwide. This is a form of energy generation, which we have to be ready to harness in the future, when all other energy sources become dearer or even inaccessible. A programme for fusion energy needs to be developed in India.

- The potential of Nuclear Energy to provide energy in the required form to meet all specific needs, mainly as grid based electricity generation but also for space and water heating, desalination of sea water to make potable water, non-grid based small nuclear power packs to supply electricity and energy at remote places etc. needs to be explored. New type of fuel and reactor configurations need to be evolved to have better performance & economics.

- For any energy option to be sustainable, it is essential to minimize its long-term environmental impact-specifically addressing the global and local environment and climate change. As per Kyoto Protocol efforts are being made world over to address these issues and it is important for India also to know and keep a watch on these concerns at the global and the national level.

BIOSCIENCE AND GENOME RESEARCH

- Rapid progress in genome science and a glimpse into its potential application have spurred observers to predict that the biology will be the foremost science of 21st Century. Technologies and resources generated already are having major impacts on research across the life science Molecular Medicine ; Microbial Genomics ; Risk Assessment ; Bioarchaeology , Anthropology, Evolution and Human Migration ; DNA

Identification ; Agriculture, Livestock Breeding ; and Bioprocessing. The nation needs programmatic direction in these areas to be at the front-end of genome science.

- Bioinformatics and Life science Informatics are also an emerging discipline, concerned with the organization, modeling, analysis, and interpretation of data and information arising from research and development within the life sciences. The considerable "algorithmic complexity" of the underlying biological systems requires a huge amount of detailed information for their complete description. Very rapidly, vast amount of biological information is becoming available including DNA / RNA and protein sequence and structure databases, metabolic and many others. The key to advances in biology lies in the organization and utilization of these information repositories and future biological experiments and studies. We need to undertake concerted programmes in these areas.

- Formidable challenges of new diseases, drug-resistant pathogens, deadlier vectors, a growing geriatric population and a strained health delivery infrastructure face the nation and the challenge is in harnessing new biology for healthcare. A strategic initiative in this direction is essential.

- Biotechnology is premier precision tool and it is these precision technologies which are today being applied for societal welfare and economic progress. We need to expand our efforts exponentially to become leaders in the world and for our own sustenance in harmony from environment.

NANOSCIENCE AND ADVANCED MATERIALS

- There has been an explosive growth of Nanoscience and technology in the last decade, primarily because, of the availability of new methods of synthesis of nanomaterials as well as tools of characterization and manipulation. A good strategic and integrated mission oriented approach is required to be in the fore front of this immensely important technology.s

- The immediate goals of the science and technology of nanomaterials could be:

* to fully master the synthesis of isolated nanostructures (building blocks) and their ensembles and assemblies and desired properties, * to explore and establish nanodevice concepts and systems architecture, * to generate now classes of high performance materials, including biology-inspired systems, * to connect Nanoscience to molecular electronics and biology, * to improve known tools while discovering better tools of investigation of nanostructures,

and * to develop applications of nanotechnology of great societal and economic relevance-say, in the production of novel materials and devices, in nanoelectronics and computer technology, space technology and in medicine and health care.

- The science of Nonmaterial is truly interdisciplinary encompassing physics, chemistry, biology, materials and engineering. Interaction amongst scientists with the different backgrounds will undoubtedly create new science and in particular new materials, with unforeseen technological possibilities. While there is some effort in nanotechnology in a few academic laboratories, there is a need to establish dedicated centers with the required infrastructure and experimental facilities.

KNOWLEDGE SOCIETY

- In the modern society, knowledge creates new opportunities for action. It drives innovation and innovation drives progress. Hence, today, knowledge is the most important force of production that drives economic growth. Creating a knowledge society is fundamental to fulfilling the vision of a developed India.

- India should leverage the power of information technology to leapfrog poverty barriers, and promote economic and social development. The ongoing miniaturization and increasing computing power will strengthen this process. In this context, it is important to bridge the 'digital divide' that threatens to marginalize the poor in India. In this context, the government needs to partner with the private sector in building a knowledge infrastructure.

- Specific action-oriented initiatives in the following areas are called for :

* India needs vast improvements in connectivity – especially in remote areas by using wireless access. Cyber cafes in the urban centers and village information kiosks in the rural areas can enhance the reach of IT. * For the masses to derive the benefits of information technology, focus should be on developing applications that support local languages. In addition, increased use of voice applications will let the people interact with computers using the spoken language. * Steps to reduce high tariff levels for hardware in India are required. Currently, the cost of hardware is significantly higher as compared to the rest of the world.

- Education is fundamental towards building a knowledge economy. Higher level and better-quality education and training of the workforce is a major stimulant for economic growth. Government, industry and academia have to partner in building a competent and industry-savvy educational system.

- An e-governance Mission needs to be launched to provide efficient citizen services and bringing government closer to the people. A broader initiative to use ICT for Development is also needed, focusing on such applications as tele-medicine, e-learning, on-line expert advice to agriculturists, etc. These would, together, help to achieve empower the masses in India.

FOOD, NUTRITION AND ENVIRONMENTAL SECURITY

- The impact to science and technology for Food, Nutrition and Environmental Security is profound, Biotechnology will play an increasingly important role in strengthening food, water and health security systems. All food safety and environmental concerns should be addressed with the seriousness they deserve. A broad bassed National Commission on Genetic Modification for Sustainable Food and Health Security should be set up, consisting of independent professionals, environmentalists, representatives of civil society, farmers' and women's organizations, mass media and the concerned Government regulatory authorities. This will help to assure both farmers and consumers that risks and benefits have been carefully and objectively assessed.

- In principle, the advances in gene revolution, eco-technology revolution and ICT-when coupled with improvements in the management and governance-greatly increase the power of a scientific approach to genetic improvement, the integrated management of natural resources and ecosystems, and the management of local and regional development strategies.

- There are two basic approaches to achieve the nutritional security, First, to help people in increasing their earnings and thereby purchasing power to get more nutritious food, and second, to improve the nutritional quality of the food commodities. The diversification of food basket with pseudo-cereals and minor millets further increases the scope of providing protein and mineral supplements in the diets of the common people. Added thrust in to be made to production of more ilk and milk products, eggs, meat and fish in the 21st century to increase the per capita availability of nutritive diet.

- Recent advances in information and communication technologies, when combined with application of contemporary instructional methods, can be the medium for education the training for societal issues-especially in disaster management. The Virtual University for climate Management will exemplify such an approach and will enable rural families and local administrators and policy makers to prepare effective responses to the emerging problem of climate induced disasters.

- A more comprehensive analysis of the spatial variation in natural resources, environmental and economic conditions that impact food and environmental security are called for. A good spatial database of the natural resources of the whole country needs to be created and updated requlary. The analysis can provide useful insights into policy directions for food, nutrition and environmental security preparedness and actions called for.

MEDICINE AND IMMUNISATION

- Molecular tools available with the researchers today give them immense power to alter every aspect of life on earth. The digital and genetic revolution together will completely redefine the meaning of health and transform disease management in the 21st century. Basic scientific discoveries will have to be translated into new therapies, vaccines and diagnostic tests meaning new medicine. Research activities will have to be focused around appropriate drags and treatments for individual ailments, which ultimately would lead to what has been called personalized medicine.

- Concrete scientific and clinical data needs to be collected to support comprehensive study of the pathogenesis of diabetes and its complications among Indians. In this light , even as scientific studies can proceed, prospects of launching a very successful prevention programme for diabetes and its complication (CAD) needs to be initiated.

- State of the art technology is now available for vaccines including use of synthetic peptide as immunogens, DNA vaccines, and plant bassed vaccines in addition to the traditional live attenuated vaccines and inactivated and pure vaccine antigens. While these technologies may deliver viable vaccines against tuberculosis, HIV and malaria against which traditional approaches have had less success, the greater challenge in the immediate future is to deliver potent, long lasting vaccines , those currently available current EPI vaccines, hepatitis B and Hib conjugate, or likely to be available in the next 5 to 7 years-pneumococcal conjugate and rotavirus vaccines.

- With advances in vaccine related science and technologies, a number of new vaccines are likely to become available in the next decade. Public health policy makers will have to make tough choices among vaccines and between vaccination with other health programs. Increasing attention needs to be devoted to developing institutional capacity and interest in health economics and build interdisciplinary groups in the country with the goal of facilitating evidence based decision making.

SPACE

- A common recommendation emerged to have global cooperation in monitoring the changes in the Earth's environment as a top priority for all space faring agencies.

- The need for a creation of an international space force for safeguarding the assets in space could be looked into.

UNIVERSITY EDUCTION

- It has to be realized that it is quality higher education and research in science that will provide the critical mass of skilled scientists and technologists in the country. There is a need to establish closer links between national research institutions and universities to give science education and research in universities a new dimension.

- Universities lack financial muscle to bring quality into their education and research. Innovative methods to financially sustain the education system need to be worked out. Strategies or financing higher education must receive utmost and efforts need to be made to work out a comprehensive national plan for this.

SCIENCE FOR SCHOOL CHILDREN

- Children must be exposed to the scientific temper and local-level Science for School Children meets be organized. The session must bring children and scientists together and provide an opportunity for children to enquire and question and for scientists to explain and make aware.

- The Indian Science Congress must be used as the opportunity to bring children to the same platform as professional scientists and give them an opportunity to learn and interact.

LEADERSHIP AND INNOVATION

- A four point agenda for innovation was called for to ensure that science and technology is effectively used as a multi pronged tool for leveraging competitiveness and imbibing quality. Firstly, there is a need for Government and Industry to invest more in R & D in prioritized sectors. Secondly, there is a need for closer interaction between the Industry and R & D institutions to market innovative products of new technologies. Thirdly, there has to be increased interaction between Industry and Academia for thrusted R & D in new areas, and finally, there has to be a sense of quality imbided in our manufacturing and productionisation.

There is a need to work out a comprehensive awareness and action plan on these.

- The Leadership Summit also emphasizes the need for all stakeholders to national development in enhancing the competitiveness of India as a whole and that of the Indian Industry in particular.

KEY SCIENCE AND TECHNOLOGY R & D

- There is an imminent need to produce more diversified food at affordable price, especially by active involvement of farmers in the development and production chain. This can be done by adoption of improved sustainable agricultural systems with mixed cropping patterns and adopting high yielding varieties.

- A sustainable and efficient management of plant genetic resources requires a focus on research that may lead to short listing and pinpointing of more number of species and genes suitable for varietal improvement programmes. This requires developing a regime of IPR protection and portfolio management and protecting the rights of farmers and producers.

- It is time to re-vitalise the age-old science of yogas which can meet the psycho-physiological needs and problems of common people. Yoga, as science, needs to be encouraged through our education and professional systems.

- Microwave processing of materials is an emerging technology area that can provide powerful and significantly different tools for materials processing. There is a need to further research in this area-especially to characterize the benefits that can accrue from microwaves as against conventional heating and processing of materials.

- There is a need to develop the research area of thermo chronology as a method to determine isotopic ages of rocks especially metamorphic petrology.

- The tapping and utilization of solar energy in India must increase, especially so when the nation is rich in sun-shine. Solar Energy technology needs to be developed and productionised to make it affordable and fail-safe and also products developed based on solar energy.