Technologies for Societal Transformation*

Dear Citizens,

I am very happy to address you all, on the Technology Day which is, commemoration of India becoming selfreliant in certain technologies. When I talked to you last year, I was referring to you nine technologies generated by our laboratories and industries which had relevance to our society and made a change. Today, I will be discussing the technological achievements of our four institutions namely the Indian Space Research Organisation (ISRO), Delhi Metro Rail Corporation, Nuclear Power Corporation of India of the Department of Atomic Energy, and Department of Telecommunications, which are pivotal in the societal transformation. My greetings to all the citizens on this technology day 11th May 2005.

CARTOSAT and HAMSAT -Twin Satellite Mission

It was a beautiful experience for me and the nation, when the 6th in the successful series of Polar Satellite Launch Vehicle (PSLV), taking off with two spacecrafts from Satish Dhawan Space Centre, Sriharikota on 5th May 2005.

CARTOSAT-1 and its features:

When satellite CARTOSAT-I was injected in the polar orbit of 618 km., it became world class earth mapper. The mission of PSLV from take off to injection of the satellites to the required orbit was achieved within 18 minutes with precision. I congratulated the Chairman, ISRO and his team for this great event. Let me talk to you, what the CARTOSAT will provide to the nation. CARTOSAT is the eleventh satellite in the Indian remote sensing satellite series, it has twin camera systems that give together stereoscopic imaging capability along the track providing 2.5 m spatial resolution and swath (width) of 30 km. The satellite has a control capability to revisit any part of our country within 5 days and transmit data in X-Band mode. A unique feature this satellite has got onboard compression and encryption with RF system of phased array antennas with 64 elements. The CARTOSAT-I with its stereoscopic imaging capability along the track will provide the country 3-D digital mapping capability.

CARTOSAT-1 will find applications related to land, water and environment management and to provide disaster management support. It will enable generation of large scale base maps, thematic maps, national level digital elevation model, digital terrain model, contour interval mapping to the extent of around 10meters. The data from CARTOSAT-1 in conjunction with other IRS Satellite data will be useful in applications such as mapping of settlements, urban utility mapping, delineation of water shed. Digital terrain model with improved accuracies will find applications in inter-river basin studies pertaining to interlinking of rivers and urban and rural infrastructure development such as rural road connectivity and alignment of national railway lines.

Another important application would be in the area of disaster management, to determine the extent of damage and the type of emergency assistance needed. This has been made possible by our space scientists by using the high resolution stereoscopic imagery from CARTOSAT-1. I am very happy to know from our space scientists that on May 7 and 8, the cameras onboard the satellite have been tested and they have reported excellent performance. Further, ISRO scientists have reported the fine tuning the path of the satellite in the

** Address to the nation by the President of India Dr. A.P.J. Abdul Kalam on the Tecnhology Day, May 11, 2005, New Delhi.*

orbit is progressing in circularization and inclination needed with respect to the equator. This successful mission of CARTOSAT-1 has definitely provided leadership to our country in the earth mapping technology in the world. We can look for another mission from ISRO in September this year: the launch of CARTOSAT-II.

HAMSAT : HAMSAT is a micro satellite for providing satellite based Amateur Radio Services to the national as well as the international community of Amateur Radio Operators (HAMS). Launched as an auxiliary payload along with CARTOSAT-1, the 42.5 kg HAMSAT will meet the long felt need of the Amateur Radio Operators in the South Asian region who possess the required equipment and to operate in the UHF/VHF band based satellite radio communication. One of the transponders of HAMSAT has been developed indigenously involving Indian HAMs, with the expertise of ISRO and the experience of AMSAT-INDIA. The second transponder has been developed by a Dutch Amateur Radio Operator and Graduate Engineering student at Higher Technical Institute, Venlo, The Netherlands.

HAMSAT is India's contribution to the International community of Amateur Radio Operators. This effort is also meant to bring ISRO's satellite services within the reach of the common man and popularize space technology among the masses. This satellite will play a valuable role in the national and international scenario by providing a low cost readily accessible and reliable means of communication during emergencies and calamities like floods, earthquakes, etc. Besides, it will stimulate technical interest and awareness among the younger generation by providing them with an opportunity to develop their technological projects including offering a platform. Just now I was talking to you how a Dutch graduate engineering student participated in the HAMSAT programme. In this context, I would like to refer the programme of micro satellite development by ISRO and Anna University as a cooperative mission. This event of micro satellite in space will definitely ignite the minds of academic community of our nation towards space research.

ISRO and its partners, have made the country one of the leaders, in space technology. We greet them.

Delhi Metro Rail Project

The Delhi Metro Rail Project has given to the nation the potential of executing a fast transportation system using high technology with reliability through a time bound mission mode operation. Delhi, the capital of the country with over 14 million population, has the distinction of having a world class metro rail with frontline technologies. The work on the metro rail commenced on1st October 1998 and the first phase with three lines covering 66 kms. is planned for completion by December, 2005.

Delhi Metro Rail Corporation has brought to the country, the most advanced rail technologies for the first time. The notable gains to the country are, light weight stainless steel, sleek, modern trains with pneumatic springs, regenerative braking, public information display, wide vestibules and automatic doors. The sophisticated coach technology which was not available in the country so far, has been transferred to M/s. Bharat Earth Movers Ltd., Bangalore, which is now assembling these trains with progressive indigenization. BEML is now in a position to supply train sets needed for Phase-II of Delhi Metro Rail Project and meet the requirement for Metros coming up in other cities of the country.

Delhi Metro Rail Corporation has brought in, a very advanced signaling and telecommunication system. This ensures that no collision can take place between two trains and drivers cannot ignore any signal. The system is called Automatic Train Protection with automatic train stop. For its Line No.2 Delhi Metro Rail Corporation has gone one step further introducing Automatic Train Operation. The entire operation thereafter is taken care of by computers and the train stops at the next station at the precise position automatically. The train speeds are controlled by computers depending upon the distance available with the train ahead. All trains have wireless communication with the Operation Control Centre (OCC) where the position of each train is displayed before the train Controllers on a wide screen. To reduce the size of tunnels, Delhi Metro Rail Corporation has adopted overhead rigid catenary for current collection. The air-conditioning and ventilation systems of the underground section is very unique which work automatically and can deal with any situation of fire, either in the tunnel or in the train, safeguarding the lives of the passengers. The most advanced Fare Collection System with Contactless Smart Cards has been introduced which gives on-line information about passenger passing through each station together with the collections. The trained crew of the automatic train system is a vital link for safe operations.

Delhi Metro Rail Corporation, with technological partnership, has given to the country a fast transportation system that is needed in many other parts of the nation. DMRC has

become a trend setter in developing advanced rail technologies and execution of cost effective time bound mission projects successfully. Such efforts will be the forerunner for many of our rural development missions.

India's first 540 MWe Pressurized Heavy Water Reactor

Now friends, let me share with you, another equally important milestone, India has achieved through our nuclear scientists and technologists, in power generation using nuclear technology.

India's first 540 MWe Pressurized Heavy Water Reactor (PHWR), built based on indigenous technology at Tarapur, Maharashtra became critical on 6th March 2005. It is the largest indigenously designed and built power reactor in the country. The commissioning of this nuclear reactor, has indeed established our technological and managerial leadership.

The design of the reactor incorporates all the basic features of the existing PHWRs. The safety features in the existing 220 MWe units, such as fast acting diverse independent shutdown systems, high pressure emergency core cooling systems, double containment, supplementary control room along with the safety objectives like redundancy diversity, avoidance of common cause failure, have been incorporated in these 540 MWe units. However, extensive theoretical and experimental development followed by manufacturing was necessary for implementing these features. Apart from this, there have been additional design innovations, which were driven with the objective of maintaining and improving the indigenisation of nuclear power plant components. Certain equipments have been redesigned so that their manufacturing is within the capability of Indian industry.

The project at Tarapur comprises of a twin-unit station of PHWR type, each of 540 MWe installed capacity and are being built adjacent to the existing two units of smaller size. The first concrete (Grade M-60) was poured on 8th March, 2000 and criticality has thus been achieved in

UNIT-4 of Tarapur Atomic Power Project Synchronised

Unit-4 of Tarapur Atomic Power Project (TAPP-4), at 540 MWe the largest unit in the country, has been synchronized to the grid on June 4, 2005.

AERB have authorised synchronization and operation of the unit upto 50% power level. Presently, the unit is in the process of conducting mandatory tests. During the testing period, electricity termed as "Infirm Power" would flow into the grid. Based on the results of these tests, and after AERB's authorisation, the power of the unit will be increased in steps to full power. In the course of performing these tests, the power from the unit would need to be varied or the unit may even be required to be shut down.

Once the station is declared commercial, it will produce electricity in a consistent manner and supply it to the grid. TAPP-4 is expected to start delivering electricity to the grid in a commercial manner, from August 2005, 8 months ahead of schedule.

The work on the other unit, TAPP-3, is in an advanced stage of completion.

TAPP-4 is India's fifteenth nuclear power reactor. It has been designed and constructed by the Nuclear Power Corporation of India Limited (NPCIL), a public sector undertaking under the Department of Atomic Energy(DAE).

NPCIL is already operating 14 nuclear power plants aggregating 2770 MWe. It is also constructing 8 nuclear power plants totaling 3960 MWe.

less than 5 years.

This is for the first time that Nuclear Power Corporation of India Limited (NPCIL) has established an automatic computer controlled batching plant and concrete was pumped to the place of concreting. Unlike earlier projects, permanent cranes and hoists were installed and commissioned in their respective position well in advance along with civil construction so that they could be made available for erection jobs inside the buildings. With the help of a heavy-duty crawler crane, the lowering of steam generator into position was completed in just three hours as against more than one month in earlier projects. Overall plant execution was done by contracting out packages of activities rather than single activities. This approach simplifies coordination, and therefore increases speed of execution of various works. This technological and project management experience will be useful for our future high-tech programme.

Various tests are being conducted on the unit before it is connected to the grid in the next few days and starts feeding power. Completing of this project in a record time of less than 5 years is a testimony to the level of maturity that has been achieved by the Indian industry and the NPCIL. At this point it is important to remember that nuclear electric power is vital for country's energy security and better quality of life of the people. When I visited project site of Tarapur plant in 2001, I was very happy to see the engineers and staff of NPCIL working round the clock with the pride that they are going to built the first Indigenous 540 MWe power station. They have done it, and India is proud of them. I am sure our nuclear scientists and technologists will add to our country 20,000 MWe power by the year 2020 as the vision propounded by our Department of Atomic Energy.

Communication is the life line of development

One of the major indicators of development in any country is the telephone penetration. For the tele-density to increase and bridge the digital divide, one needs a combination of affordable technologies and proactive policies along with a vibrant private-public partnership. The important technology that made this revolution possible is the cell phone technology. Due to its ease of deployment, it caught on very well and this resulted in larger user base and hence cheaper and more functional products. Today the cell phone has become the most preferred access medium not only for voice calls but also for e-mails, secure banking and even mobile commerce. With the later generation of communication technology coming in world over, with India being not far behind, the technology, would enhance voice capacity and higher data rates and would enable the e-governance, e-entertainment, e-health, e-education and e-commerce.

In recent time, the Indian environment has become so stimulating that in India, telephones have changed from luxury items to an item of necessity and we see that the technology has become an integral part of every citizen's life. The Indian telecom sector is the fastest growing sector (35%) of the economy with more than 100 million telephones. In terms of number of phones, India has the fifth largest network after China, USA, Japan and Germany. The turnover of the telecom industry today is more than Rs. 50,000 crore and it contributes more than Rs. 6500 crore to the central exchequer. The share of private sector has also increased to around 45% in terms of the total number of phones. Today, this high growth rate has resulted due to governmental policy of competitiveness in choice of technology and partnership in operation and management in telephone communication system. Studies indicate that the income of corporate and households increased by 5% to 10% by the use of telecom services. For the rural population, it provides access to information and makes facilities available irrespective of one's location.

Since the rural telephone penetration is still lower, it is a fertile market for telecom services. For this to happen, the rural population should find the value for the money and also have the buying power. These are intertwined. Our future efforts should be to increase the contents delivered through the telephone networks both in terms of the quality and utility for the rural population. If this is done by the year 2010 we would witness one of the technological marvels that will actually bridge the digital divide and provide an electronic connectivity to the clusters of villages forming part of PURA complexes and make the whole of India as a connected nation. I am sure that public private partnership with innovative government policies will definitely lead India to become a developed nation by the year 2020. I extend my greetings to all the contributors in this technological and managerial venture telecommunication.

Conclusion

The four events of technologies, which I have discussed so far, are indeed part of many more technologies we need, for leading the nation

as a prosperous country. The pictures of CARTOSAT-1 must be used by farmers, development institutions, educational institutions and the industry to understand the resource available with us and make use of the resources for the benefit of all citizens.

HAMSAT should motivate our youth to develop an urge towards amateur communication which can be a hobby and also be a backup communication at critical times. Delhi Metro Rail Project should lead to development of metro systems in many of our cities to cope up with the increasing traffic needs. Indigenous development and commissioning of 540 MWe pressurized heavy water reactor is indeed a forerunner for the mission of leading the generation of 20,000 MWe of nuclear power by the year 2020. The growth in telecommunications will bridge the rural-urban divide and contribute towards making India into a knowledge society.

Dear friends, I would like every year on this Technology Day, the Central and State Governments, private sector institutions, industrial corporate and NGOs to initiate PURAs (Providing Urban Amenities in Rural Areas) through physical, electronic, knowledge connectivity and thereby leading to economic connectivity of our rural sector. Let these technological successes multiply and bring smiles in the faces of billion people. This indeed will lead to the celebration of technological achievements. My best wishes for success in all the missions of our nation.

May God Bless You.

Hon'ble President Dr. A.P.J. Abdul Kalam at the European Nuclear Research Organisation (CERN), Geneva, Switzerland