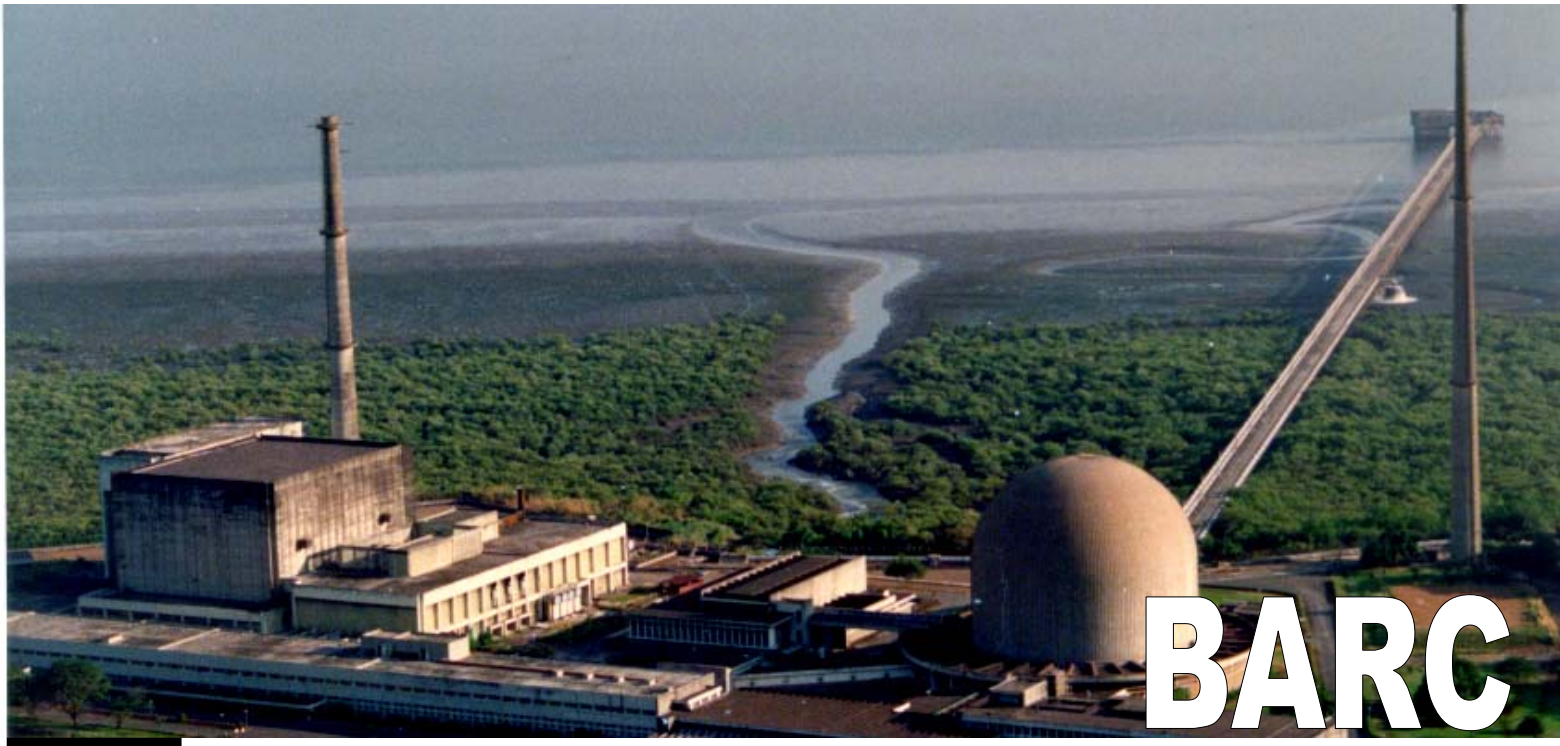

BARC NEWSLETTER

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PRIME MINISTER VISITED BARC

Hon'ble Prime Minister Dr Manmohan Singh inaugurated the 16th Annual Conference of the Indian Nuclear Society (INSAC-2005) & Supercomputing Facility of Bhabha Atomic Research Centre on November 15, 2005. Dr S. Banerjee, Director, BARC, welcomed Hon'ble Prime Minister Dr Manmohan Singh, Mr Vilasrao Deshmukh, Hon'ble Chief Minister of Maharashtra & Mr Prithviraj Chavan, Hon'ble Minister of State, PMO, with floral bouquets. Dr R. Chidambaram, Principal Scientific Adviser to Govt. of India & President, Indian Nuclear Society, in his welcome address said, "Visit of our Prime Minister to BARC is an inspiration to the scientific community". Dr Anil Kakodkar, Chairman, Atomic Energy Commission, in his address, referred to the resolve of DAE's scientific community to achieve the twin objectives of security and energy empowered India.

Dr S. Banerjee, Director, BARC, welcoming Hon'ble Prime Minister Dr Manmohan Singh with a flower bouquet at Central Complex Auditorium, BARC

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Highlights of PM's Visit

- Inaugurated the Supercomputing Facility of Bhabha Atomic Research Centre on November 15, 2005.
- Inaugurated the 16th Annual Conference of the Indian Nuclear Society (INSAC-2005)
- Released three commemorative volumes of the Golden Jubilee year of the Department of Atomic energy
- Gave away INS Awards-2004 to the scientists & engineers for their outstanding achievements in the fields of science & technology.

Dr R Manmohan Singh said that India was keen on establishing an environment that was conducive to international cooperation in peaceful use of nuclear energy without compromising the country's national policy of maintaining the strategic requirements. He announced that the Government would double the investment in science and technology and it would be around two percent of GDP.

Dr S. Banerjee, Director, BARC, said that as a part of the celebration of the Golden Jubilee year of the Department of Atomic energy, it was planned to publish three commemorative volumes to capture the entire saga of the growth of developmental activities in the Department.

The programme on basic sciences is covered in the book entitled "The Chain Reaction". The development of nuclear technology is the theme for the second book entitled "Atoms with Mission", and applications of radiation and radioisotopes are featured in the third book entitled "Atoms for Health and Prosperity". The three commemorative volumes were released at the hands of the Hon. Prime Minister.

Dr Manmohan Singh also gave away INS Awards-2004 to the scientists & engineers for their outstanding achievements in the fields of science & technology. INS Medals were awarded to Mr Chetan Parkash Kaushik, Dr Hari Sharan Misra, Dr U. Kamachi Mudali, Mr Ranjay Sharan, Ms Sherly Ray and Mr M. Suresh in recognition of their excellent contribution in the fields of science & technology.

INS Awards were presented to Mr Om Prakash Goyal, Mr Sharaf Ali Bohra, Dr Baldev Raj, Dr Tulsi Mukherjee, Dr Lalit Varshney and Mr Beant Prakash Sharma in view of their outstanding achievements in the field of science & technology.

INS Science Communication Award-2004 was presented to Mr Gorachand Chakraborty in view of his dedicated and sustained efforts for popularisation of science and technology.

Dignitaries on stage (from left) Mr R.K. Sinha, Director, RD & DG, BARC, Dr Anil Kakodkar, Chairman, Atomic Energy Commission, Dr R. Chidambaram, President, Indian Nuclear Society, Dr Manmohan Singh, Hon'ble Prime Minister of India, Mr Vilasrao Deshmukh, Hon'ble Chief Minister of Maharashtra, Mr Prithviraj Chavan, Hon'ble Minister of State, PMO and Dr Srikumar Banerjee, Director, BARC.

INS Industrial Excellence Award-2004 was awarded to Advanced Technology Products Division of Bharat Heavy Electricals Ltd., Tiruchirappalli.

INS Homi Bhabha Lifetime Achievement Award-2004 was awarded to Mr Virendra Kumar Sharma for his outstanding contributions related to all facets of Nuclear Energy Programmes of the Department.

Dr R. Chidambaram, Principal Scientific Adviser to Govt. of India & President, Indian Nuclear Society, delivered a special lecture on "Frontier in Science and Cutting Edge Technology'. He highlighted the need of our presence in frontier areas in science since we have to close nuclear fuel cycle with thorium and also look at the possibilities of generating nuclear power through fusion or accelerator driven systems. Through developments of technologies, we create national wealth and improve quality of life of our rural population. There is a need to enhance national security since national development is related to it. The programme was attended by a huge gathering of senior scientists/engineers from all over the country.

The technical sessions of the 16th Annual Conference of Indian Nuclear Society (INSAC-2005) were held during November 16 – 18, 2005. These sessions covered the entire gamut of scientific disciplines, which constitute the foundation of nuclear technology. The topics discussed included physics, biological aspects, emerging nuclear energy systems, modeling and mathematical sciences, chemistry, materials, and nuclear applications. In all 33 invited talks and 122 poster papers were presented during the Conference. These papers brought out the emerging trends in different domains of nuclear sciences and technology.

The full text of PM's address is reproduced below.

Prime Minister's address on the occasion of inauguration of 16th Annual Conference of Indian Nuclear Society at BARC

My esteemed friend Chief Minister of Maharashtra, Mr Vilasrao Deshmukhji, my colleague in the PM's Office Mr Prithviraj Chavanji, Dr R. Chidambaram, President of the Indian Nuclear Society, Dr Anil Kakodkar Chairman of the Atomic Energy Commission, Dr Homi Sethna, former Chairman of the Atomic Energy Commission, Mr R.K. Sinha, Dr Banerjee, Distinguished scientists, ladies and gentlemen,

It is always a pleasure to visit this magnificent campus of the Department of Atomic Energy in

Hon'ble Prime Minister Mr Manmohan Singh addressing at the 16th Annual Conference of Indian Nuclear Society

the great city of Mumbai. I am delighted to join the Indian Nuclear Society in recognizing excellence in scientific achievement. My good wishes are with you, in particular, today's award winners, for your achievements in the cause of science.

It is a particular pleasure to be here, not merely because the Bhabha Atomic Research Centre is one of India's premier institutions, but also because it enables me to pay tribute to the vision of titans such as Dr Homi Jehangir Bhabha and Pt. Jawaharlal Nehru. This institution symbolizes, in bricks and mortar, their aspirations for our nation. For its part, BARC has lived up to our expectations as a Centre of world-class excellence. I also acknowledge our debt to BARC for training generations of scientists to direct vital national programmes. Given Dr Bhabha's abiding passion for physics, it is fitting that we meet today at the Bhabha Centre, in the International Year of Physics. And the fact that this also is the centenary year of Einstein's now-legendary

formula E= mc^2 makes this a most unique opportunity to be with you.

Ladies and Gentlemen,

In the light of his other magnificent contributions to our nation, it is easy to overlook Dr Bhabha's achievements in his own subject. I am told his work in elementary particle physics is still cited among researchers. However, Dr Bhabha's name will forever be associated with his phenomenal contribution to institution-building in the formative years of our Republic. His ability to weave together diverse disciplines in the institutions he built was, of course, legendary.

Besides his formidable managerial skills, Dr Bhabha's vision of our national development strategy synchronized with that of Prime Minister Jawaharlal Nehru. In one of his last public addresses in 1966, Dr Bhabha ascribed the failure to adopt and continuously assimilate modern technology as an important reason for ancient societies such as ours falling behind in the race for development. The affinity between Dr Bhabha and Pt. Nehru was based on a common vision that absorption of technology and investing in development of indigenous and appropriate scientific capabilities were a sine qua non for rapid economic development. Nehru underlined that it was "only by adopting the most vigorous measures, and by putting forward our utmost effort into the development of science that we can bridge the gap." He also affirmed that it was an inherent obligation of a great country like India to "participate fully in the march of science, which is probably mankind's greatest enterprise today".

Much of what I have said about Panditji and Dr Bhabha is not new. However, it bears repetition to underline the level of difficulty, at that early dawn of freedom, to build a climate of opinion supportive of expending scarce resources on scientific and technological institutions. This was done without expecting immediate returns, realizing that benefits would accrue to the nation over generations. History has borne out the vision of J awaharlal Nehru. If today we speak with pride of our technological capabilities, it is largely due to his vision of a new and modern India. Panditji's commitment to creating institutions of higher education and science inspired visionary scientists such as Dr Bhabha and Dr Sarabhai to share his dream of a vibrant, modern and secure India. It is their vision of selfless service, dedication to science and the indomitable spirit of self-reliance that your Centre has inherited.

Ladies and Gentlemen,

In the five decades since the Science Policy Resolution of 1958, the Department of Atomic Energy has recorded signal successes. You have vindicated the faith reposed in you by our country and I applaud your accomplishments. But we cannot rest on our laurels in this competitive age. The nation has heightened expectations from you. We now look to you to help realize our developmental objectives. We need you to redouble your efforts to achieve the long-awaited quantum jump in power production. Our national objective involves a substantial increase in the contribution of the nuclear sector in our energy mix, based on the three-stage process through Fast Breeder Reactor technology, culminating in the use of our abundant Thorium resources. There are important technological milestones ahead but we have every confidence that our scientists will achieve each one. This is one area where science and technology hold the key to the nation's future energy security and economic well-being.

The need for success is all the more pressing as we strive to raise millions of our people from the clutches of poverty. Our goal of eliminating the age-old scourges of hunger, poverty, ignorance and chronic disease needs unprecedented effort by all institutions, and every element in society. Fifty years ago, our scientists created the first wave of development based on application of advanced research and modern technology. The nation now looks to you once again, to raise the tempo of development through creation and

application of cutting-edge technologies. This requires a renewed focus on our mission and the passion to excel in all that we do. In this competitive world, we cannot slacken in our efforts to catch up with developed countries.

I fully realize that this goal will not be reached solely through your own isolated efforts. Government must augment research facilities to meet future challenges. I assure you of the Government's fullest support to encourage R&D. Our Government has been increasing investment in S&T. Ultimately, we aim to raise this investment to around 2% of GDP, double the current allocation. However, to do so, we need to ensure that our economy generates adequate resources. This is where our technology sector, and indeed each one of you, has a role to play. We must also devise innovative approaches to maximize benefits from each rupee that we spend.

Monitoring technological advances elsewhere, and widening the involvement of our young scientists in various projects, enables us to ensure that learning opportunities and access to new developments are not restricted to a minuscule segment of our population. Emerging technologies need to be tracked, assimilated and adapted to our own circumstances through concerted effort. Therefore, we need to greatly widen the absorptive base among our scientists to maximize dissemination of technology among our people. Dr Chidambaram has often spoken of 'Coherent Synergy'; a strategy of national scientific development taking place simultaneously along multiple vectors, promoting synergy, with all these vectors moving in the same direction to ensure coherence.

This brings me to the announcement I made during my last visit here. At that time, I announced that the Homi Bhabha National Institute had received recognition as a deemed University. It is my fervent hope that HBNI will seize this opportunity to become a major contributor to our pool of qualified scientific manpower. This is obviously one of the best investments our nation can make in the cause of development. This is all the more important given the obvious limits on our financial resources, to provide our institutions with the best facilities and faculty that they deserve.

With such constraints, it is important for us to pool our national resources and capabilities. We must strengthen interaction between laboratories, academic institutions and industrial establishments. Ensuring high quality, cost-effective communications infrastructure linking our scientific institutions, and laboratories, is an important objective. The development of an efficient "Grid Technology" linking our institutions—and our foreign partners—will revolutionize communications in the manner that STD telephony reconnected our country. I am therefore optimistic that in the near future our scientists, teachers and students will also be part of a networked community, interconnected with each other and the rest of world.

At the same time, better physical infrastructure is not the only answer to better cooperation between our institutions. Our systems and institutions must evolve a culture of flexibility, receptivity and adaptability to external ideas and personnel. I am happy to learn that DAE and UGC have already initiated steps to further expand upon the symbiotic relationship between the Department and our universities. Your recent initiative under the Inter University Consortium for DAE Facilities to expand Universities' access beyond the subject of physics to your research facilities is commendable.

Apart from expanding interaction across academic institutions domestically, we must also focus on international cooperation. Increasingly, large-scale scientific projects have made it imperative for nations to join hands, both to share costs and to benefit from the largest pool of expertise. Some of these projects are now the subject of public interest. These include the International Thermonuclear Experimental

Reactor project, the Large Hadron Collider (being set up by CERN), the Generation IV International Forum to develop advanced nuclear reactors, and the Satellite Navigation programme, Galileo. India's effort to be an equal partner in these projects requires a nationally coordinated approach. I have personally flagged our interest in some of these projects with world leaders, and I am happy that we are eliciting a positive response. This is fitting recognition of the capabilities and achievements of our scientists.

Before I conclude, I would like to briefly touch upon another aspect of international cooperation in meeting the challenge of our future energy security. I refer to the issue of our agreement with the United States of America, during my visit to that country in July this year, to revive international cooperation for our civilian nuclear energy sector. We have an interest in the establishment of an enabling environment, conducive to international cooperation in the peaceful uses of nuclear energy. We must create the space for a quantum jump in nuclear energy production in the coming decades, in a manner that is consistent with our national policy of maintaining the integrity of our three-stage nuclear energy programme, without constraining strategic and R&D related aspects of our nuclear programme.

Ladies and Gentlemen,

I thank you for giving me the pleasure of joining you. I congratulate the award winners once again. I wish each and every one of you success in your careers and satisfaction in your scientific endeavors. May your path be blessed!

Thank you.

भाभा परमाणु अनुसंधान केंद्र, ट्रॉम्बे में आयोजित भारतीय नाभिकीय संस्था के १६वें वार्षिक सम्मेलन के उद्घाटन के समारोह के अवसर पर प्रधान मंत्री का संबोधन

मेरे सम्मानित मित्र महाराष्ट्र के मुख्य मंत्री श्री विलासराव देशमुखजी, प्रधानमंत्री कार्यालय के मेरे साथी श्री पृथ्वीराज चव्हाणजी, डॉ.आर.चिदम्बरम्, भारतीय नाभिकीय संस्था के अध्यक्ष डॉ. अनिल काकोडकर, परमाणु ऊर्जा आयोग के अध्यक्ष डॉ. होमी सेठना, भूतपूर्व अध्यक्ष, परमाणु ऊर्जा आयोग डॉ. आर.के.सिन्हा, डॉ. बॅनर्जी, प्रतिष्ठित वैज्ञानिकों, देवियों एवं सज्जनों

इस महान मुंबई शहर में स्थित परमाणु ऊर्जा विभाग के इस भव्य परिसर में आना हमेशा एक अत्यंत प्रसन्नतादायक अनुभव रहा है। भारतीय नाभिकीय संस्था द्वारा वैज्ञानिक उपलब्धियों के क्षेत्र में उत्कृष्टता को मान्यता देने संबंधी इस आयोजन में आप के बीच आकर बड़ी खुशी हो रही है । मेरी शुभकामनाएं आपके साथ हैं, विशेषरूप से पुरस्कार विजेताओं के लिए, विज्ञान के क्षेत्र में प्राप्त आपकी उपलब्धियों के लिए ।

यह एक विशेष अनुभव है, केवल इस लिए नहीं कि भाभा परमाणु अनुसंधान केंद्र भारत के शीर्ष संस्थानों में से एक है, बल्कि इसलिए कि यहां आने से मैं डॉ. होमी जहांगीर भाभा एवं पंडित जवाहर लाल नेहरू जैसे महान स्वप्नदृष्टाओं को अपनी श्रद्धांजलि अर्पित कर सकता हूँ । इस संस्थान के कण-कण में राष्ट्र के प्रति उनकी भावनायें झलकती हैं । अपनी ओर से भापअ केंद्र ने भी विश्वस्तरीय उत्कृष्ट केंद्र के रूप में हमारी अपेक्षाओं को पूरा किया है । मैं भापअ केंद्र के प्रति आभार व्यक्त करता हूँ क्योंकि इसने मुख्य राष्ट्रीय कार्यक्रमों हेतु वैज्ञानिकों को प्रशिक्षित किया है । डॉ.भाभा का भौतिकी के लिए अति उत्साह देखने पर यह उचित ही है कि हम आज अंतरराष्ट्रीय भौतिकी वर्ष में भापअ केंद्र में मिल रहे हैं । यह भी वास्तविकता है कि आइंस्टाइन के ऐतिहासिक सूत्र $E=mc^2$ को सौ वर्ष हो चुके हैं, अत: आपके साथ होने का यह और भी विशेष अवसर बनता है ।

देवियों और सज्जनों,

राष्ट्र के लिए उनके और भी अन्य उत्कृष्ट योगदानों को देखते हुये डॉ. भाभा के अपने ही विषय पर किये गये कार्यों को ध्यान से देखना सरल होगा । मुझे यह भी बताया गया है कि उनके द्वारा प्राथमिक कण भौतिकी में किये गये कार्य आज भी

अनुसंधानकर्ताओं के बीच उद्धत किए जाते हैं । तथापि, डॉ. भाभा का नाम हमारे गणतंत्र निर्माण के प्रारंभिक वर्षों के दौरान संस्था निर्माण के प्रति उनके महत्वपूर्ण योगदान के साथ हमेशा जुड़ा रहेगा, उनके द्वारा निर्मित संस्थानों में विभिन्न विषयों को एक सूत्र में बाधने की क्षमता तो वास्तव में सराहनीय है ।

उनके अत्यंत कुशल प्रबंधन के अतिरिक्त राष्ट्रीय विकास नीति के बारे में डॉ. भाभा की दूरदृष्टि हमारे प्रधान मंत्री जवाहर लाल नेहरू की अवधारणा से काफ़ी मिलती जुलती थी । वर्ष १९६६ में उनकी अंतिम सभाओं में से एक आम सभा में डॉ. भाभा ने इस बात का उल्लेख किया था कि हमारे समाज में आधुनिक प्रौद्योगिकी को लगातार अपनाने में विफलता ही विकास की दौड़ में हमारे जैसे प्राचीन समाज के पिछड़ने का कारण है। डॉ. भाभा एवं पंडित नेहरू के बीच का संबंध उनके एक समान दर्शन पर आधारित था जो प्राद्योगिकी को अपनाकर देशी एवं समुचित वैज्ञानिक क्षमताओं के विकास को बढ़ावा देकर राष्ट्रीय विकास को तीव्र गति से बढ़ाने के बारे में था । नेहरू ने इस बात को रेखांकित किया कि केवल अत्यंत गहन उपायों को अपनाकर एवं विज्ञान के विकास में अथक प्रयास के द्वारा ही इस अंतर को पाटा जा सकता है । उन्होंने यह भी कहा कि भारत जैसे महान देश का यह उत्तरदायित्व बनता है कि विज्ञान के क्षेत्र में बढ़ चढ़कर हिस्सा लें जो आज मानव जाति का सबसे बड़ा उद्यम बन चुका है ।

जितना भी मैंने पंडित जी और डॉ. भाभा के बारे में कहा है वह कुछ नया नहीं है । फिर भी, स्वतंत्रता के प्रारंभिक वर्षों में वैज्ञानिक एवं प्रौद्योगिकी संस्थाओं हेतु पहले से ही कम उपलब्ध संसाधनों में से सहायता प्रदान करने हेतु अनुकूल माहौल बनाना बहुत बड़ी बात थी । यह कोई तत्काल परिणाम की अपेक्षा किये बिना ही यह सोचकर किया गया कि इससे राष्ट्र की आने वाली पीढ़ियाँ अवश्य लाभान्वित होंगी । इतिहास ने जवाहर लाल नेहरू के सपने को साकार किया है । यदि आज हम हमारी प्रौद्योगिकी क्षमता के बारे में गर्व से बात करते हैं तो वह नए एवं आधुनिक भारत के निर्माण के प्रति उनकी दूरदृष्टि के कारण है । उच्चस्तरीय शैक्षणिक एवं वैज्ञानिक संस्थाओं के निर्माण हेतु पंडितजी की प्रतिबद्धता ने डॉ. भाभा एवं डॉ. साराभाई जैसे स्वप्नदृष्टा वैज्ञानिकों को उनके आधुनिक एवं सुरक्षित भारत के सपने को साकार करने हेतु प्रेरित किया। यह उनकी विज्ञान के प्रति निस्वार्थ सेवा, समर्पण एवं स्वावलंबिता का अटल चिंतन है जो आपके केंद्र को विरासत में मिला है ।

देवियों और सज्जनों :

वर्ष १९५८ की वैज्ञानिक नीति संकल्पना के समय से इन पांच दशकों में परमाणु ऊर्जा विभाग द्वारा सतत सफलतायें प्राप्त की गई हैं । आपने देश द्वारा आप में व्यक्त विश्वास को कायम रखा है, जिसके लिए मैं आपको बधाई देता हूँ। परंतु इस प्रतियोगितात्मक युग में हम अपनी उपलब्धियों को लेकर निश्चिंत बैठे नहीं रह सकते । राष्ट्र को आपसे बड़ी अपेक्षाएं हैं । अपने विकास संबंधी लक्ष्यों को पूरा करने हेतु हम आपकी ओर देख रहे हैं । विद्युत उत्पादन की मात्राको बढ़ाना हो तो आपको दुगुने प्रयास करने होंगे । हमारा राष्ट्रीय लक्ष्य ऊर्जा के क्षेत्र में नाभिकीय क्षेत्र के योगदान को बढ़ाने पर निर्भर है जिसमें तीव्र प्रजनक रिएक्टर प्रौद्योगिकी तथा हमारे प्रचुर मात्रा में उपलब्ध थोरियम भंडार के उपयोग का समावेश है। आगे और भी महत्वपूर्ण प्रौद्योगिकीय पड़ाव हैं परन्तु हमें विश्वास है कि हमारे वैज्ञानिक हरेक पड़ाव को पार करेंगे । यही एक ऐसा क्षेत्र है जिसके माध्यम से राष्ट्र भविष्य में ऊर्जा सुरक्षा एवं आर्थिक संपन्नता प्राप्त कर सकता है ।

इस सफलता प्राप्ति की अब और भी अधिक आवश्यकता है क्योंकि हमें अपने लाखों लोगों को दरिद्रता के चंगुल से छुड़ाना है । भूख, दरिद्रता, अज्ञानता एवं बीमारियों से मुक्ति पाने के लिए समाज की हर संस्था और हर तबके को क्रियाशील होना पड़ेगा । पचास वर्ष पहले हमारे वैज्ञानिकों ने प्रगत अनुसंधान एवं आधुनिक प्रौद्योगिकी के अनुप्रयोग के आधार पर विकास की पहली लहर दौड़ायी थी । राष्ट्र अब फिर से आपकी ओर देख रहा है कि, आप पुनः अतिआधुनिक प्रौद्योगिकियों के सृजन एवं अनुप्रयोग द्वारा विकास की गति को बढ़ाएं । इसके लिए हमें अपने लक्ष्यों का पुनः निर्धारिण करना होगा एवं सभी कामों में उत्कृष्टता ही हमारा उद्देश्य होना चाहिए । इस प्रतिस्पर्धात्मक विश्व में, हमें विकसित देशों के बराबर आने के लिए अपने प्रयासों में ढिलाई नहीं लानी जाहिए ।

मुझे मालूम है कि इस लक्ष्य की प्राप्ति आपके अकेले के प्रयासों से नहीं हो सकती है। सरकार द्वारा भविष्य की चुनौतियों को पूरा करने हेतु अनुसंधान सुविधाओं का उन्नयन करना होगा। अनुसंधान एवं विकास कार्य को प्रोत्साहन देने हेतु मैं सरकार की ओर से पूर्ण सहयोग का आश्वासन देता हूँ। सरकार द्वारा विज्ञान एवं प्रौद्योगिकी में निवेश को बढाया जा रहा है । अंततः हम इस निवेश को सकल घरेलू उत्पाद (जीडीपी) के २% तक बढ़ाना चाहते हैं जो वर्तमान से दुगुना होगा । फिर भी, हमे ऐसा करने के लिए यह सुनिश्चित करना होगा कि हमारी अर्थ व्यवस्था से पर्याप्त साधन प्राप्त हो सकें । यही वह बिन्दु है जहां हमारे प्रौद्योगिकी क्षेत्र तथा आप में से प्रत्येक व्यक्ति को अपनी भूमिका निभानी होगी । हमें खर्च किये गये प्रत्येक रुपये से अधिकतम लाभ पाने हेतु नयी युक्तियां खोजनी होंगी ।

अन्यत्र हो रही प्रौद्योगिकी की प्रगति का मानीटरन कर एवं विभिन्न परियोजनाओं के साथ युवा वैज्ञानिकों को सम्मिलित करने से, हम यह सुनिश्चित कर सकेंगे कि सीखने के अवसर एवं नये विकासों तक पहुँच हमारी जन संख्या के थोड़े से हिस्से तक ही सीमित न रहें । नवोदित प्रौद्योगिकियों को एकत्रित प्रयासों के द्वारा अपनी अनुकूल परिस्थिति के अनुसार अपनाना होगा । अतः हमारे वैज्ञानिकों को आत्मसात करने की अपनी क्षमता को विस्तृत करना चाहिए ताकि विज्ञान को आम जनता तक पहुंचाया जा सके । डॉ. चिदम्बरम् द्वारा अक्सर सुसंगत सहयोग के बारे में कहा जाता है । एक राष्ट्रीय वैज्ञानिक विकास जो सभी संबद्धता सुनिश्चित करने के लिए आगे बढ़ रही है ।

मेरे पिछली बार यहां आगमन के दौरान की गई अपनी घोषणा की ओर आपका ध्यान आकर्षित करना चाहता हूँ । उस समय मैंने घोषित किया था कि होमी भाभा राष्ट्रीय संस्थान ने डीम्ड यूनिवर्सिटी के रूप मे मान्यता प्राप्त की है । मुझे पूरी आशा है कि एचबीएनआई इस अवसर का लाभ उठाते हुए योग्य वैज्ञानिक समुदाय की वृद्धि में पूरा योगदान देगा । राष्ट्र द्वारा विकास के लिए किया गया यह एक उत्कृष्ट निवेश है । यह हमारे लिए बहुत महत्वपूर्ण है कि हम अपने सीमित वित्तीय संसाधनों का समुचित प्रयोग करते हुए अपने संस्थानों और फैकल्टी को उनके योग्य उत्कृष्ट सुविधायें उपलब्ध करायें । इन कठिनाइयों के साथ हमारे लिए यह महत्वपूर्ण है कि हम अपने राष्ट्रीय संसाधनों और क्षमताओं को संगठित करें । हमें प्रयोगशालाओं, शैक्षणिक संस्थाओं और औद्योगिक स्थापनाओं के बीच अंतःसंपर्क को मजबूत बनाना चाहिए । उच्च गुणवत्ता को सुनिश्चित करते हुए अपने वैज्ञानिक संस्थानों और प्रयोगशालाओं के बीच अंतःसंपर्क के लिए किफायती संचार ढांचा तैयार करना हमारा एक महत्वपूर्ण उद्देश्य है । हमारे संस्थानों और हमारे विदेशी भागीदारों के बीच संपर्क के लिए एक सक्षम ` ग्रिड प्रौद्योगिकी ' के विकास से हमारे संचार तंत्र में क्रांति आयेगी, बिलकुल उसी तरह जैसे कि एसटीडी टेलीफोन के द्वारा देश को जोड़ा गया है। इसलिए मुझे आशा है कि निकट भविष्य में हमारे वैज्ञानिक, प्राध्यापक और छात्र एक ऐसे नेटवर्क समुदाय का हिस्सा होंगे जो आपस में तथा विश्व के शेष भाग से अंतर संपर्कित होगा ।

साथ-साथ केवल बेहतर भौतिक अवसंरचना ही हमारे संस्थानों के बीच बेहतर सहयोग की द्योतक नहीं होगी । हमारे सिस्टम और संस्थानों को नम्यता, ग्रहणशीलता और बाह्य विचारों तथा व्यक्तियों के प्रति अनुकूलनशीलता की संस्कृति का विकास करना चाहिए । मुझे यह जानकर खुशी हुई है कि परमाणु ऊर्जा विभाग और विश्वविद्यालय अनुदान आयोग ने विभाग एवं हमारे विश्वविद्यालयों के बीच आपसी संबंधों के और अधिक विस्तार के लिए पहले ही कई कदम उठाये हैं । परमाणु ऊर्जा विभाग सुविधाओं के लिए अंतरविश्वविद्यालय कंसोर्टियम के अंतर्गत विश्वविद्यालयों को भौतिकी विषय से परे आपकी अनुसंधान सुविधाओं के साथ संपर्क बढ़ाने का अभी हाल ही में किया गया आपका प्रयास प्रशंसनीय है ।

देश में शैक्षणिक संस्थानों के बीच अंतरसंबंधों को बढ़ावा देने के अलावा हमें अंतरराष्ट्रीय सहयोग पर भी अपना ध्यान केंद्रित करना चाहिए । बड़े पैमाने पर निर्मित होने वाली वैज्ञानिक परियोजनाओं के कारण राष्ट्रों के बीच लागत तथा विशेषज्ञों के बड़े समूह से लाभान्वित होने जैसे कार्यों में सहयोग आवश्यक हो गया है । इन परियोजनाओं में से कुछ जनहित से संबंधित हैं। इनमें अंतरराष्ट्रीय ताप भौतिकी प्रायोगिक रिएक्टर परियोजना, लार्ज हेड्रान कोलाइडर (सर्न द्वारा स्थापित किया जा रहा है) चौथी पीढ़ी के प्रगत नाभिकीय रिएक्टरों के विकास का अंतरराष्ट्रीय फोरम तथा उपग्रह नेविगेशन कार्यक्रम, गेलीलियो का समावेश है । इन परियोजनाओं में बराबर के साझीदार होने से संबंधित भारत के प्रयासों के लिए एक राष्ट्रीय समग्र पहल का होना आवश्यक है । मैंने

व्यक्तिगत रूप से इन परियोजनाओं के बारे में विश्व नेताओं से अपनी रुचि प्रदर्शित की है तथा मुझे खुशी है कि हमें सकारात्मक प्रतिसाद मिला है । यह हमारे वैज्ञानिकों की क्षमताओं और उपलब्धियों के लिए एक उपयुक्त मान्यता है ।

अपना वक्तव्य समाप्त करने के पहले मैं अपने देश की भावी ऊर्जा सुरक्षा से संबंधित चुनौती का सामना करने के लिए अंतरराष्ट्रीय सहयोग से संबंधित एक अन्य मुद्दे पर संक्षेप में अपना विचार रखना चाहूँगा । मैं इस संबंध में इस वर्ष जुलाई में अपनी अमेरिका यात्रा के दौरान हमारे सिविलियन नाभिकीय ऊर्जा सेक्टर के लिए अंतरराष्ट्रीय सहयोग के बारे में उनके साथ हुए करार के मुद्दे पर आपका ध्यान आकृष्ट करना चाहता हूँ । हम नाभिकीय ऊर्जा के शांतिमय उपयोग के क्षेत्र में सकारात्मक अंतरराष्ट्रीय सहयोग के प्रति एक अनुकूल वातावरण के निर्माण में रुचि रखते हैं । हमें आगामी दशकों में नाभिकीय ऊर्जा के उत्पादन के क्षेत्र में एक ऐसी लंबी छलांग लगानी है जो हमारे नाभिकीय कार्यक्रम से संबंधित सामरिक एवं अनुसंधान एवं विकास कार्यो में कोई व्यवधान डाले बिना हमारे तीन चरणों वाले नाभिकीय ऊर्जा कार्यक्रम के लिए बनायी गयी हमारी राष्ट्रीय नीति के अनुरूप हो।

देवियों और सज्जनों,

मैं आप सबको यहां मेरे साथ उपस्थित होने के लिए धन्यवाद देता हूँ । मैं सभी पुरस्कार विजेताओं को पुनः बधाई देता हूँ । मेरी कामना है कि भविष्य में आप और सफलताएं प्राप्त करें और अपने वैज्ञानिक प्रयासों में संतोषजनक परिणाम प्राप्त करें । ईश्वर आपको आपके कार्यपथ पर आगे बढ़ने के लिए आशीर्वाद दें ।

धन्यवाद ।

SUPERCOMPUTING FACILITY INAUGURATED AT BARC

The Honourable Prime Minister of India, Dr Manmohan Singh, inaugurated a new Supercomputing Facility at Bhabha Atomic Research Centre, Mumbai, on November 15, 2005.

BARC's Supercomputing facility consists of TeraFlop class 512-node ANUPAM Super-computer, High Resolution Tiled Display Cluster; Terabyte Storage Clusters and many other

The new building of the Computer Division, BARC, where the Supercomputing Facility is installed, was inaugurated by the Hon'ble Prime Minister Dr Manmohan Singh

Dr Banerjee, Director, BARC, explaining on the Anupum supercomputer to the Hon'be Prime Minister Dr Manmohan Singh. To PM's right seated is Hon'ble Minister of State, PMO, Mr Pritiviraj Chavan, and to his left is Hon'ble Chief Minister of Maharashtra, Mr Vilasrao Deshmukh

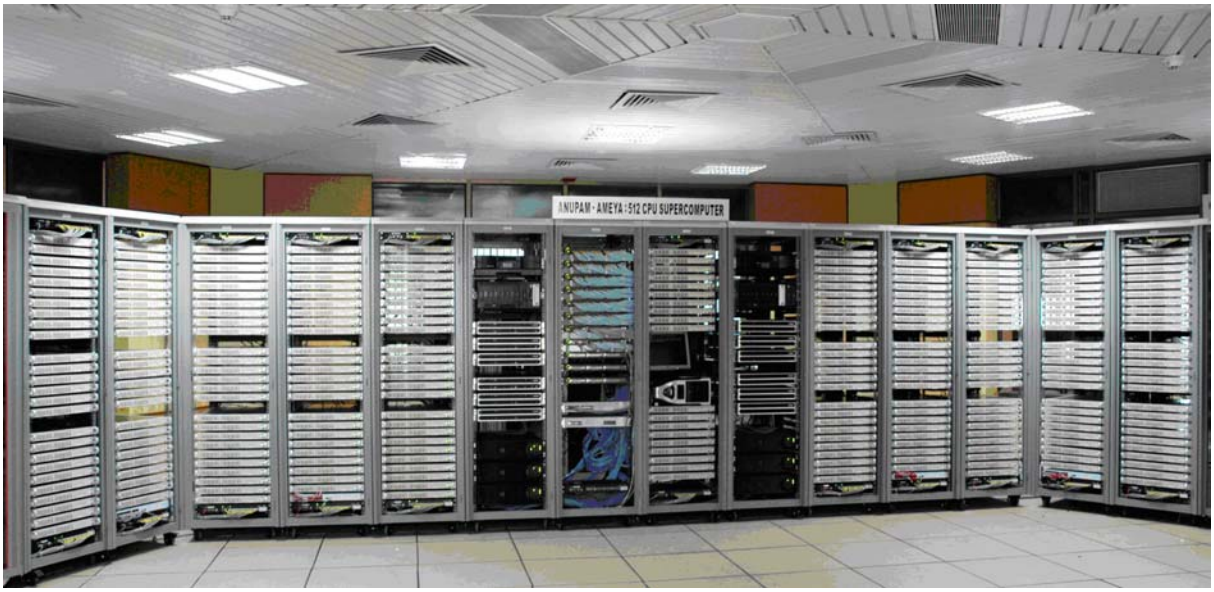
BARC had achieved a significant milestone in 2003 by developing ANUPAM parallel processing system, attaining highest computing performance of 365 Gigaflops for High Performance Linpack (HPL) benchmark on 128 node system. The availability of such enormous computing power has given tremendous boost to deployment of high-end scientific and engineering applications in BARC by enabling users to solve complex 3-D computation intensive problems in a reasonable time frame, which were impossible to be solved even on the fastest available conventional computer.

powerful Computing Clusters integrated seamlessly, using ultra-fast network technology via Computing Grid. The Computing Grid helps to aggregate distributed computing resources such as computing power, storage capacity, network bandwidth, graphics capability, etc. in a manner similar to electric power being tapped from an electric Grid. Grid technology presents a single, unified resource for solving large-scale computational and data-intensive computing applications.

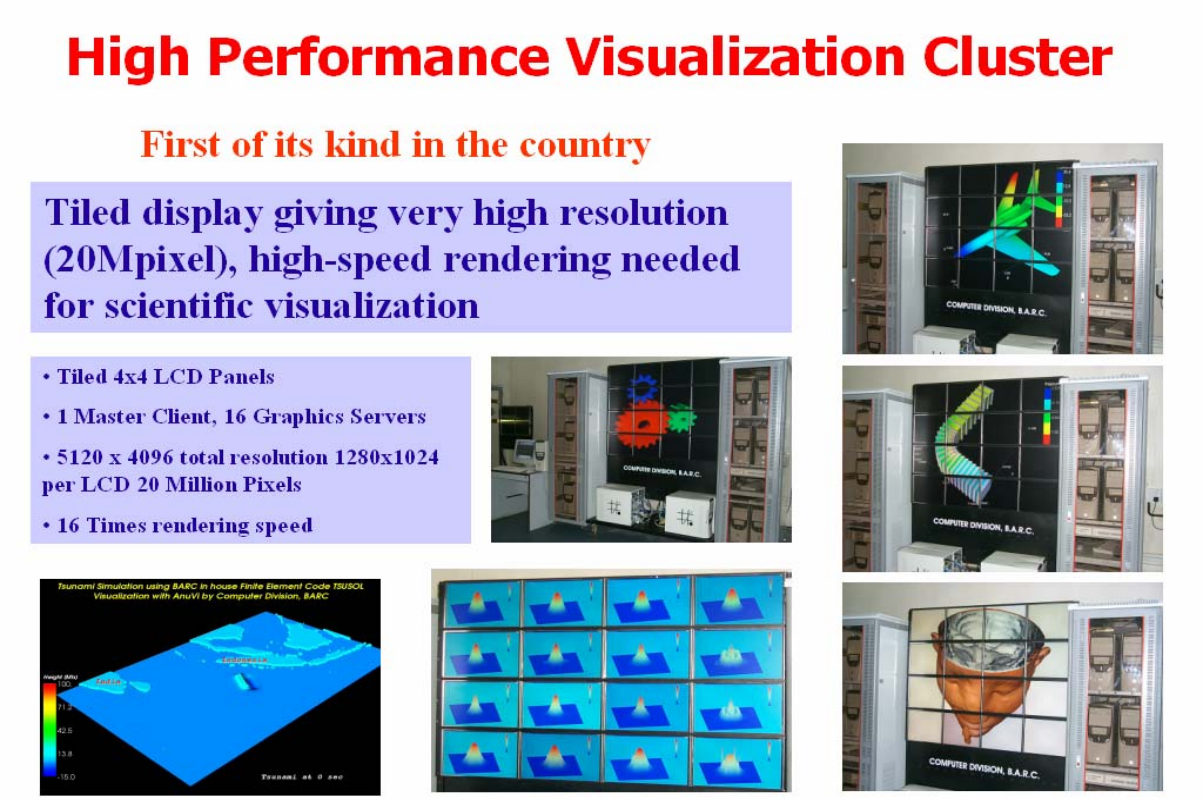
The Supercomputing environment has been fully designed and developed by a highly dedicated team of computer scientists & engineers of BARC, harnessing capabilities of Free & Open Source Software (FOSS) and deploying a number of commodity components available from indigenous sources. Use of sound software engineering practices, reusable component technology and plug and play hardware design has not only provided very robust, highly scalable and easily upgradeable supercomputing infrastructure but has also resulted in drastic reduction in costs.

BARC recently installed 64 Node ANUPAM-PIV parallel cluster at Institute of Plasma Research, Gandhinagar. ANUPAM-ALPHA supercomputer installed at National Centre for Medium Range Weather Forecasting, Noida, in 1999 by BARC is in regular use and continue to provide them regular operational weather forecasts. ANUPAM systems are also in regular use at Aeronautical Development Agency, Bangalore, and Vikram Sarabhai Space Centre, Thiruvananthapuram. So far BARC has developed 16 different ANUPAM models and about 36 ANUPAM systems are in regular use in many leading Educational and Research institutes in India.

Another successful development at BARC is that of a high-resolution (5120x4096) wall-size tiled display system using commercially available multiple LCDs (4x4) interfaced with a parallel cluster, providing advanced data visualization capability, which is the first of its kind in the country. A high-end post processor software package, ANU-View, has also been developed to facilitate users to visualize their voluminous data graphically.



512 Node Anupam-Ameya



As a part of DAE-CERN collaboration programme, BARC has also developed many Grid middleware tools namely SHIVA - a problem tracking system, Grid-View - a Grid operations and monitoring system, Fabric monitoring, etc., which are deployed in LCG grid at CERN, Geneva, and are in regular use. European Organization for Nuclear Research (CERN) is building Large Hadron Collider (LHC), the largest accelerator in the world, for searching Higgs particle leading to the understanding of the origin of masses of fundamental particles and unification of fundamental forces of nature. The LHC represents a leap forward in particle beam energy, density and collision frequency. The extraction of results from the LHC experiments will present a number of challenges in terms of computing, due to the unprecedented complexity and rates of the data, the length of time of the programme and the large (presently 1800

physicists, 150 institutes, 32 countries) geographically, distributed scientific communities that will coherently need to operate on these data. CERN is meeting the computing challenge of LHC by using Grid Computing technology with the objective of exploiting widely dispersed Large National Computing facilities located in various countries.

Although the probability of a beyond design base accident at nuclear power plant is very very low (~ 1 event in 1 million reactor year operations), BARC has developed an Indian Real time Online Decision Support System "IRODOS", for handling off-site nuclear emergency in the event of an accident at Nuclear Power Plant, following the defence in depth practices of BARC. This is an online system, which senses a nuclear accident and communicates to the round the clock monitoring emergency response centre. It estimates the likely release of contaminant into the environment and suggests the counter measures to be taken, along with the availability of logistics, to assist the emergency response team handling the crisis. The online system has 72 hours meteorological forecast from NCMWRF, Noida, with hourly resolution and update every 24 hours. The system provides instantaneous information about the optimum counter measures to be taken at affected places to minimise the radiological exposure to the public and to the environment.

BARC has set up a real time seismic monitoring and tsunami alert system at Mumbai. The system comprises a seismic sensor network, real time data acquisition system, a VSAT based data communication system and a data center. The data from Mumbai, Gauribidanur and Delhi seismic arrays are collated and processed in real time at this centre to obtain source parameters within a short duration and provide necessary alert to various facilities of the DAE.

Whether an earthquake is tsunamigenic or not, depends on various parameters such as the location of the earthquake, the source depth at which the fault slip occurred, the event magnitude, water depth above the hypocenter and the focal mechanism. BARC has developed a novel method to determine focal mechanism solution, using artificial neural networks (ANNs), particularly for the earthquakes of Sumatra region. The ANN based method, which relies on the amplitudes of P and later seismic phases, will be significant when data are available from only one or a few stations. The online estimated source location can be quickly refined interactively using conventional and genetic algorithm based location software developed in-house. For quick estimation of the source depth, a method based on the difference of body wave and surface wave magnitude is used. Once all the relevant parameters are estimated, together it will be possible to indicate whether an earthquake would be tsunamigenic or not.

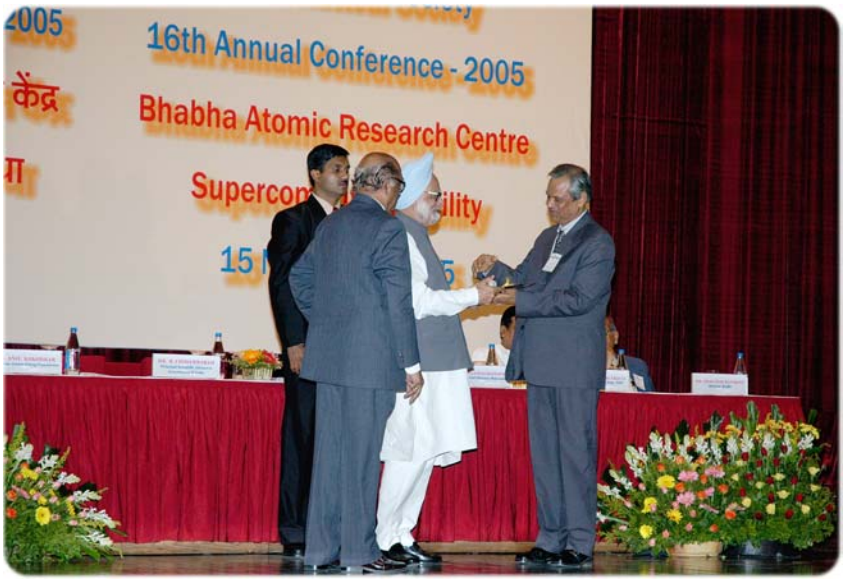
PRIME MINISTER PRESENTS INS- 2004 AWARDS

Indian Nuclear Society (INS) organised its sixteenth Annual Conference – INSAC 2005 on "Science Behind Nuclear Technology" during November 15 – 18, 2005 in Mumbai.

The four-day Conference was inaugurated by Honourable Prime Minister of India, Dr Manmohan Singh, on Tuesday, November 15, 2005 at 1500 hrs at the Central Complex Auditorium of Bhabha Atomic Research Centre, Mumbai. Hon'ble Mr Vilas Rao Deshmukh, Chief Minister of Maharashtra, Hon'ble Mr Prithvi Raj Chavan, Minister of State in the office of Prime Minister, Dr R. Chidambaram, President INS, and Principal Scientific Advisor to the Government of India, and Dr Anil Kakodkar, Chairman, Atomic Energy Commission and Secretary, Department of Atomic Energy, also graced the occasion

During this inaugural function, the Prime Minister also gave away INS Awards for the year 2004.

Former Executive Director of NPCIL, Mr Virendra Kumar Sharma, was awarded the INS Homi Bhabha Lifetime Achievement Award – 2004. Mr Om Prakash Goyal, Station Director of Narora Atomic Power Station (NAPS), Mr Sharaf Ali Bohra, Director (Procurement) and Executive Director (Projects & Procurement) NPCIL, Dr Baldev Raj, Director, IGCAR, Dr Tulsi Mukherjee, Director, Chemistry Group, BARC, Dr Lalit Varshney from RC & I Group, and Mr Beant Prakash Sharma, Associate Director, Materials Group, BARC, were given the INS Award – 2004. Mr Gorachand Chakraborty was given the INS Science Communication Award – 2004. Advanced Technology Products (ATP) Division of Bharat Heavy Electricals Limited, Tiruchirapalli was awarded the INS Industrial Excellence Award – 2004. Mr Chetan Prakash Kaushik, Dr Hari Sharan Misra , Dr U. Kamachi Mudali, Mr Ranjay Sharan, Smt Sherly Ray and Mr M. Suresh were awarded INS Medal – 2004.



Mr Virendra Kumar Sharma receiving the INS Homi Bhabha Lifetime Achievement Award from the Hon'ble Prime Minister Dr Manmohan Singh

INS Homi Bhabha Lifetime Achievement Award – 2004

Mr Virendra Kumar Sharma was conferred the INS Homi Bhabha Lifetime Achievement Award - 2004 in recognition of his immense contributions in the field of nuclear energy. Mr V. K. Sharma, a Mechanical Engineering graduate of BARC Training School, joined the Department of Atomic Energy in August 1964. An exceptionally brilliant engineer, Mr Sharma has made outstanding contributions in the development of the Indian nuclear power programme, covering almost all facets of the technology including R&D, design, safety analysis, planning, procurement, construction, project management, commissioning and operation. Mr V.K. Sharma was one of the principal architects of the design of the country's first 540 MWe Pressurised Heavy Water Reactor based nuclear power plants, the first of which became operational at Tarapur in the year 2005. He was directly responsible for the design of Reactor Process Systems including development and indigenous manufacture of key components like pumps, valves, pressuriser, steam generators, canned motor moderator pumps, etc. In March 1996, he took charge of Kaiga Nuclear Power Plant at a crucial time, when the problem of reconstruction of reactor dome, had to be solved. He provided guidance in developing high performance concrete required for the reconstruction. These units have been operating at high performance levels since 1999-2000. Due to his outstanding contributions, he was awarded Padma Shri in 2002 by the Government of India. After thirty-nine years of meritorious service, Mr Sharma relinquished his office in March 2003 as Sr. Executive Director (Technical). Subsequently, Mr Sharma provided his services for six months for the development of larger sized 700 MWe PHWR units. He led a team of highly motivated engineers for this work, and was instrumental in the submission of Preliminary Safety Analysis Report of this reactor to AERB in August 2003.

INS Awards – 2004

Mr Om Prakash Goyal was conferred the INS Award – 2004 in recognition of his outstanding achievements in the field of Nuclear Reactor Technology. Mr O. P. Goyal joined Rajasthan Atomic Power Station (RAPS) in 1970 after completing the 13th course of BARC Training School in Electrical Engineering discipline. He made significant contributions to the commissioning and operation of RAPS - 1& 2, replacement of Over Pressure Relief Device in RAPS-1 and Enmasse Coolant Channel Replacement in RAPS-2. He was also responsible for the commissioning of RAPP-3 & 4 turbo-generators, feed water and electrical systems in a record time and ahead of schedule.

Mr Om Prakash Goyal receiving the INS Award 2004 from the Hon'ble Prime Minister Dr Manmohan Singh

During the period 2001-2005, Mr Goyal served as the Station Director of Narora Atomic Power Station (NAPS). Under his able leadership, both the units of this Station operated at their full capacity and created new records of excellence in several areas. The Station registered an annual capacity factor of 93.08% in the calendar year 2002 and ranked third in the world among the Pressurised Heavy Water Reactors. NAPS Unit-2 set a record for continuous operation of 272 days, while both the units of NAPS set a record for simultaneous continuous operation of 238 days. The Station was awarded "GOLD SHIELD" consecutively for two years (2001-2003) by Hon' ble President of India, Dr A. P. J. Abdul Kalam. The Station also won the "SHRESHTHA SURAKSHA PURASKAR" for the year 2003, awarded by the National Safety Council of India for development and implementation of highly effective occupational safety & health culture (2003). This Station completed the highest ever 'ACCIDENT and FIRE FREE operation period' among all stations of NPCIL and won a series of Industrial Safety Gold Awards. The Station also achieved a significant downward trend in collective radiation exposure by adopting good work practices and improved safety culture. Mr Goyal was instrumental in the achievement of these new standards of excellence through his excellent leadership and technical acumen.

Mr Sharaf Ali Bohra was conferred the INS Award – 2004 in recognition of his outstanding achievements in the field of Nuclear Reactor Technology. Mr S. A. Bohra graduated from the 9th batch of the BARC Training School in Mechanical Engineering in 1966 and was awarded one of the first Homi Bhabha prizes. He has worked in various positions in the construction and commissioning of Rajasthan Atomic Power Station Units -1 & 2 and Narora Atomic Power Station Units -1& 2. He has specialised in the area of Turbo Generators and Feed Water Systems. As Chief Engineer (Mechanical), he has created an extensive knowledge base in the areas of Wet Cycle and balance-of-plant. He contributed immensely in improving the performance of Turbo Generator & Feed Water Systems through R&D work including study of rotor dynamics, online condition monitoring, blade material properties, FEM analysis, special inspection techniques, etc., and created a strong team in NPCIL in these areas. He has also contributed

Mr Sharaf Ali Bohra receiving the INS Award 2004 from the Hon'ble Prime Minister Dr Manmohan Singh

significantly to the development of the first desalination plant project by BARC with nuclear power integration. As Director (Procurement) and Executive Director (Projects & Procurement), Mr Bohra developed new management systems in the areas of procurement, Mega Package concept for projects, integrated project management and mechanisation in construction. These innovations contributed greatly in reducing the gestation period of construction and reduction in manpower. Mr Bohra is on the Governing Boards of the World Association of Nuclear Operators and many International and DAE committees. Through his excellent technical and managerial qualities, Mr Bohra has been instrumental in improving the competitiveness of nuclear power in India.

Dr Baldev Raj receiving the INS Award 2004 from the Hon'ble Prime Minister Dr Manmohan Singh

Dr Baldev Raj was conferred the INS Award - 2004 in recognition of his outstanding achievements in the field of Nuclear Fuel Technologies. Dr Baldev Raj is a distinguished metallurgist who has made sustained excellent contributions towards maturing of indigenous science and technology of Fast Breeder Reactors and fuel reprocessing. The success of the FBTR programme today, including the achievement of high burn up (1,48,000 MWd/t) in FBTR fuel pins and reprocessing of the unique carbide fuel irradiated to 100,000 MWd/t for the first time in the world, owes a lot to the technological contributions of Dr Baldev Raj. State-of-the-art Post-Irradiation Examination (PIE) facility and the neutron tomography in the KAMINI Reactor are representative examples of his contributions. He is presently steering the science and technology programmes of the Indira Gandhi Centre for Atomic Research with a mission to develop world class technologies in Fast Breeder Reactors and Closed Fuel Cycle.

Dr Baldev Raj is internationally acclaimed for his important contributions in the development and applications of advanced non-destructive evaluation techniques to a variety of challenging problems concerning quality assurance, structural integrity assessment and life management of plant components and

structures. He has also made a variety of seminal contributions to materials characterisation, corrosion science & technology, welding and hardfacing. He has made outstanding contributions to the development and successful implementation of in-situ repair welding of cracked shrouds and blades of steam turbines and development of indigenous stainless steel and modified 9Cr-1Mo welding electrodes for the FBR-500 being built at Kalpakkam, Tamil Nadu. Dr Baldev Raj is a Fellow of Indian National Academy of Engineering, Indian Academy of Sciences, Bangalore, The National Academy of Sciences, Allahabad, and Tamil Nadu Academy of Sciences. He has won major awards such as NDT Man of the Year, National Metallurgist, G.D. Birla Gold Medal, Keith Hartely Award, International Committee on NDT Researcher Award, VASVIK Award, Lifetime Achievement Award of Indian Society for Nondestructive Testing, Lifetime Achievement Award of Indian Welding Society, MRSI-ICSC Super-conductivity & Materials Science Annual Prize and Jaeger Award of International Institute of Welding. He is a member of Standing Advisory Group on Nuclear Energy, International Atomic Energy Agency; Scientific Advisory Council to Prime Minister and Committee on Nano Science & Technology Initiative of Department of Science & Technology. He is Member, Board of Directors, Bharatiya Nabhikiya Vidyut Nigam Ltd. and Nuclear Fuel Complex. He has more than 640 publications in leading national and international journals, 32 books and special volumes of journals and 14 patents to his credit. He has contributed 9 articles in various Encyclopaedias and a large number of reviews in high impact journals.

Dr Tulsi Mukherjee was conferred the INS Award -2004 in recognition of his outstanding achievements in the field of Radiation and Photochemical research. Dr Tulsi Mukherjee joined the Chemistry Division of the Bhabha Atomic Research Centre after completing the 15th course of BARC Training School in Chemistry discipline. Since then he has been contributing in radiation and photochemical research. Dr Mukherjee and his research team has brought BARC into global recognition in ultra-fast time-resolved studies, spanning over femtoseconds to seconds, by establishing several sophisticated fast kinetic techniques like electron pulse radiolysis, laser flash photolysis, ultra fast laser spectroscopy, time-resolved fluorescence spectroscopy and many others.

Dr Tulsi Mukherjee receiving the INS Award 2004 from the Hon'ble Prime Minister Dr Manmohan Singh

He has utilised radiation from accelerators and lasers as a tool for societal benefit, through his immense research contribution in the areas of anticancer and other drugs, antioxidants, novel metal nanoparticles and electron and energy transfer in organic and biological systems. His contribution towards human resource development in DAE and Indian universities is very well recognised. He has developed a strong research team of international standard in his subject area in BARC and has over 220 research publications in journals. Dr Mukherjee is presently Director, Chemistry Group, Bhabha Atomic Research Centre.

Dr Lalit Varshney receiving the INS Award 2004 from the Hon'ble Prime Minister Dr Manmohan Singh

Dr Lalit Varshney was conferred the INS Award – 2004 in recognition of his outstanding achievements in the field of Radiation Processing applications. Dr Lalit Varshney joined the Isotope Group, Bhabha Atomic Research Centre, in 1982 after completing 25th course of BARC Training School. Dr Varshney's original and innovative contributions in the area of radiation processing of polymers and pharmaceuticals have given a lead to understanding and development of Radiation Processing Applications. His work has significantly contributed to the solving of difficult problems in health care and pharmaceutical sectors and helped in the successful growth of Radiation Sterilisation Technology in India and developing countries. Dr Varshney's dedicated research work on Hydrogels resulted in the development of technology of 'Hydrogel Dressing'. The Hydrogel is highly effective and safe for treating burns, non-healing ulcers of diabetes and leprosy, animal bites, bedsores, donor areas in plastic surgery, etc. reducing sufferings of large number of people. Dr Varshney is currently engaged in the development of advanced materials for medical and environmental applications using radiation technology.

Mr Beant Prakash Sharma was presented INS Award - 2004 in recognition of his outstanding achievements in the field of High Technology Nuclear Materials Development. Mr B. P. Sharma joined the Metallurgy Division of BARC after successfully completing the 12th course of BARC Training School. He has made important contributions in materials development. In particular, he has been associated with the beryllium development programme since its inception and has brought it up to the position of Beryllium Pilot Plant (BPP) which processes beryl ore to the end product vacuum hot pressed beryllium materials. Under his leadership, BPP has supplied beryllium shapes for a variety of applications starting from photoneutron sources required for the start up nuclear reactors (including FBTR and PRP); windows for X-ray tubes and neutron detectors, ΔT neutron spectrometer, critical components for various space applications and also components for special nuclear experiments. In 1990,

Mr Beant Prakash Sharma receiving the INS Award 2004 from the Hon'ble Prime Minister Dr Manmohan Singh

Beryllium Pilot Plant was renamed as Powder Metallurgy Division to provide an opportunity for the diversification of activities. Under the leadership and proactive approach of Mr B. P. Sharma, the Division has successfully developed a number of oxide and non oxide ceramics, gadolinium aluminate, dysprosium titanate, boron carbide and special boron alloy pellets meant for burnable poison and shut-off rods, of direct and immediate application in the on-going programmes of the Department. Mr Sharma has a natural flair and aptitude for design of powder metallurgy related equipment. He has, to his credit, a number of process equipment that were developed for beryllium processing. Currently Mr Sharma is leading a group of scientists and engineers in the development of materials related to the development of Solid Oxide Fuel Cells, thermoelectric conversion and hydrogen storage. He is also guiding the design of a micro-electrochemical cell meant for elucidating the influence of different phases on the corrosion behaviour of alloys.

Mr Gorachand Chakraborty receiving the INS Science Communication Award 2004 from the Hon'ble Prime Minister Dr Manmohan Singh

INS Science Communication Award - 2004

Mr Gorachand Chakraborty was presented the INS Science Communication Award – 2004 in recognition of his dedicated and sustained efforts for popularisation of science and technology, particularly in the field of nuclear science and technology. Mr G. Chakraborty joined BARC Training School in August, 1967 after obtaining his BE degree in Electrical Engineering. Subsequently, he obtained his M.Tech degree in Power System Engineering. He started his career with work in the field of dynamics and transient analysis of Nuclear Power Plants. His expertise has been helpful in the design and modifications in the Indian Pressurised Heavy Water Reactors (PHWRs) including the 540 MWe PHWR units. He is also associated with several activities for regulatory safety review of the design and operation of the nuclear power plants in India. Mr Chakraborty is a fine science communicator. He regularly writes popular science articles in Hindi and Bengali for the benefit of the students and general public. His recent book titled "Production of Electricity by Nuclear Energy" is the first of its kind written in Hindi language. In this book he has explained in simple language the science, technology and safety aspects of Nuclear Power Plants. The book also provides an overview of the energy scenario in India and explains the need for rapid development of Nuclear Power in the country. This book has also been translated into Bengali. Both the books have been reviewed in different magazines and highly praised.

INS Industrial Excellence Award - 2004

Advanced Technology Products (ATP) Division of Bharat Heavy Electricals Limited, Tiruchirappalli was presented the INS Industrial Excellence Award – 2004 in recognition of its commendable contribution in the development of major critical equipment for the Indian nuclear programme. To meet the stringent quality requirements of major equipment for nuclear power programme, Bharat Heavy Electricals Limited, Tiruchirappalli (BHEL) started its

Mr A.K. Pui, CMD, BHEL receiving the INS Industrial Excellence Award 2004 from the Hon'ble Prime Minister Dr Manmohan Singh

Advanced Technology Products (ATP) Division in the early seventies. This Division has manufactured and supplied a number of critical equipment like Heavy Water Headers , Reactor Headers, Steam Generators, Stainless Steel Vessels, Reactor Vessels Piping, Intermediate Heat Exchangers, etc. to various agencies engaged in the nuclear programme of India, viz. NPCIL, BARC, Institute of Plasma Research (IPR), BHAVINI and IGCAR. The Division has manufactured and supplied the complete TOKAMAK equipment for IPR. In addition to these high-tech equipment, many new related technologies were developed in-house.

ATP Division has also developed critical manufacturing processes like cladding, deep-hole drilling, thread whirling, metal forming, machining of spigots and critical autogenous welding of spigot/tube joints, etc. Special process for electro polishing of TOKAMAK components and ultrasonic cleaning techniques were also developed by this Division. This Division has established a full fledged Engineering Design Section, the only one in the country, with capabilities to design of 500 MW and 700 MW Nuclear Power Plant equipment. The 540 MW Steam Generators designed and manufactured by this Division are in operation at the Tarapur Atomic Power Station.

INS Medals - 2004

Mr Chetan Prakash Kaushik was awarded INS Medal – 2004 in recognition of his commendable contributions in the treatment and conditioning of different types of radioactive wastes. Mr C.P. Kaushik joined the Waste Management Division of BARC after successfully completing 28th course of BARC Training School in chemistry discipline. Since then he has been actively involved in design, establishment and operation of Process Control Laboratories at Waste Management Facilities located at different places. He has done commendable job in developing a process for treatment of Intermediate Level Waste using caesium selective sorbent which facilitated safe treatment of more than 300 m^3 of waste at WIP, Tarapur. Mr Kaushik has also developed a glass formulation based on barium borosilicate matrix

Dr Chetan Prakash Kaushik receiving the INS Medal 2004 from the Hon'ble Prime Minister Dr Manmohan Singh

for vitrification of sulphate bearing high level radioactive liquid waste (HLW) generated at Plutonium Plant, Trombay. Based on his work, around 9000 kg of vitrified waste product has been successfully made, meeting desired safety acceptance criteria for immobilising 1,45,000 Ci of radioactivity and thus confirming suitability of the matrix. Mr Kaushik is presently involved in development of vitreous matrices for waste which are likely to be generated from future reactors. He is also involved in screening of microbes and plants with bioremediation potential for removal of radioisotopes. He has served as consultant in IAEA meeting for formulating a Coordinated Research Programme pertaining to characterisation of swelling clays for use as buffer / backfill materials in nuclear waste repositories. He has 38 publications in national and international journals and conferences.

Dr Hari Sharan Misra receiving the INS Medal 2004 from the Hon'ble Prime Minister Dr Manmohan Singh

Dr Hari Sharan Misra was awarded INS Medal – 2004 in view of his excellent contribution in molecular genetics of bacterial response to ionising radiations and agricultural biotechnology. Dr H. S. Misra joined BARC in 1990 after completion of his Doctorate from G.B. Pant University, Pantnagar. Dr Misra has made significant research contributions in areas related to agricultural productivity and bacterial resistance to ionising radiations. His initial work elucidated the close interaction between photosynthesis and nitrogen fixation in cyanobacteria. He also developed genetic constructs that are being used to develop insect-resistant transgenic crops at BARC, and also at University of Agricultural Sciences, Dharwad. His post-doctoral work at New Jersey, USA elaborated the mechanism by which HIV-1 reverse transcriptase creates mutations in viral genome during virus multiplications. Dr Misra's recent work has unraveled novel mechanisms of radiation tolerance in Deinococcus radiodurans mediated by natural antioxidants and radioprotectors such as pyrroloquinoline-quinone (PQQ) and involving efficient recombination pathways for DNA double strand break repair.

Dr U. Kamachi Mudali was awarded the INS Medal – 2004 in view of his excellent contribution in corrosion science and technology. Dr U. Kamachi Mudali joined Indira Gandhi Centre for Atomic Research, Kalpakkam in 1984 after obtaining M.Tech. degree in Corrosion Science and Engineering from IIT Bombay. Dr Mudali, a corrosion specialist, has made original and innovative contributions in materials and coating technology relevant for fast breeder reactor and spent fuel reprocessing applications. He has made excellent contributions in understanding localised corrosion behaviour of nitrogen alloyed stainless steels for PFBR applications. His studies helped in choosing materials/procedures for sodium-to-air heat exchanger, interim wet storage facility, hard chromium coating, surface treatment and storage of components. Dr Mudali's significant contributions to reprocessing applications include: development of electrode materials (MOCTA, PMMPCTA, MOCTAG) for

Dr U. Kamachi Mudali receiving the INS Medal 2004 from the Hon'ble Prime Minister Dr Manmohan Singh

electrochemical processes, selection of titanium for electrolytic dissolver and explosive joining for linking titanium and 304L SS, corrosion protection DOCTOR coating on titanium, and dynamic nitric acid loop for corrosion studies.

Mr Ranjay Sharan was awarded INS Medal – 2004 in view of his excellent contribution in project management techniques for TAPS 3&4. After graduation in Mechanical Engineering Mr Ranjay Sharan completed 31st course of BARC Training School. He has also done MBA with specialisation in Finance. Subsequently, he was posted at Tarapur site for starting TAPP- 3 & 4 works. He played a very important role in Pre-project activities of TAPP – 3 & 4 during 1989-96 which also included package formulation and pre-qualification of vendors for main plant works.

Mr Ranjay Sharan receiving the INS Medal 2004 from the Hon'ble Prime Minister Dr Manmohan Singh

During 1996-2000, he worked in Corporate Planning Group of NPCIL and successfully completed the corporate level planning and monitoring of RAPS-2 Coolant Channel Replacement and up-gradation work, and implementation of Kaiga-1&2 and RAPP – 3&4 after restart of dome work with the new design. In 2000, he was posted at TAPP - 3&4 as Site planning Engineer and made responsible for all planning and I.T. works for speedy implementation of the Project. He was awarded NPCIL unit recognition award for his contributions. He has played a vital role in reducing the gestation period of TAPP - 3&4 and bench marking the same with the international standards. Due to his active involvement, TAPP-3&4 has adopted the latest project management techniques comparable to those in any of the multi-national companies in the world.

Ms Sherly Ray was awarded the INS Medal – 2004 in recognition of her excellent contribution in design related physics calculations of 540 MWe PHWR. Ms Sherly Ray joined NPCIL, Mumbai, in 1990 after completion of one year training at Nuclear Training Center, MAPS. Since then she is involved mainly in the design related physics calculations of 540 MWe PHWR. Her analysis of behaviour of Xenon induced oscillations caused by different reactivity perturbations and capability of Reactor Regulating System to control these oscillations led to design changes in nominal water levels and height of few Zone Control Compartments

Ms Sherly Ray receiving the INS Medal 2004 from the Hon'ble Prime Minister Dr Manmohan Singh

working with Larsen & Toubro Limited in Research and Development department of E&C Division as a Technologist for over 16 years. He carried out surface treatment for PFBR prototype reheater and his feed back on orientation of certain nozzles for better surface treatment has been incorporated in the steam generators. He has a running patent on behalf of L&T on a coating process to improve galling and corrosion resistance of load bearing

(ZCCs) which resulted in better controllability of reactor core. She has been involved in working out different fueling strategies for conservation of natural uranium resources. Significant savings of natural uranium have been achieved with these strategies. She has made significant contributions towards the theoretical estimates related to first approach to criticality and phase-B and phase-C physics experiments of TAPP - 4. The observed results were in good agreement with the theoretical predictions. She has been advising site reactor physicists in preparation of fueling programme for maintaining desired flux profile either centrally peaked or flat, as the case may be, and large scale depleted uranium use on a regular basis in operating reactors.

Mr M. Suresh receiving the INS Medal 2004 from the Hon'ble Prime Minister Dr Manmohan Singh

Mr M. Suresh was awarded INS Medal – 2004 in view of his excellent contribution in the field of Materials Science including Surface Treatment and Failure analysis. Mr M. Suresh has been

Stainless Steel parts. His contribution in the field extends to the development of various surface treatment processes for nuclear, defence and aerospace components. By his systematic analysis, chloride stress corrosion cracking of one of the half made nuclear end-shields, and the cause of discolouration of nuclear steam generator tube to tube sheet weld joints could be established. He has analysed over 60 failure cases so far that have been nicely compiled into three volumes of failure analysis album.

ELECTRONIC HARDWARE STANDARDIZATION ACTIVITY IN REACTOR CONTROL DIVISION

G. Ganesh and B.B.Biswas
Reactor Control Division

Introduction

A working group on Electronic Hardware Standardization (WG – EHS) was constituted by Director, E & I Group, BARC. The mandate of this WG was to design and develop standard hardware boards to meet the requirements of BARC and other DAE units. Since these boards will be used extensively in all future reactor and non-reactor applications, these are to be designed based on present day technology and components in order to overcome obsolescence problem in the near future. Accordingly, the working group short listed on three major bus architectures for the design of these boards. VME and a proprietary I/O bus have been chosen for embedded system development and PCI bus for PC based system development owing to their popularity, availability of boards from multiple vendors and our prior experience with these architectures.

Reactor Control Division has taken up design, development and testing of boards for Embedded systems as part of X Plan activity. A majority of embedded systems that have been developed so far in Reactor Control Division are highly I/O intensive and, in order to relieve CPU from I/O tasks, the I/O boards have been planned as intelligent I/O boards. To obtain higher density in terms of I/O and to minimize power consumption, it was decided to use SMD components and low voltage devices (3.3V). These I/O boards support hot-swap feature which is an essential requirement in power plants. This eliminates the need to put off a system for replacing a faulty I/O board. These boards support geographic addressing thus eliminating address related on-board jumpers. These boards have been designed with extensive self-diagnostic features in order to detect faults on-line, thereby simplifying system maintenance. Further, the sequencer is implemented on a FPGA using hardware description language so that any change in requirement can be easily incorporated.

Types of Boards

The following is the list of boards that have been taken up for immediate design and development since these constitute the major hardware building blocks for most control and monitoring systems.

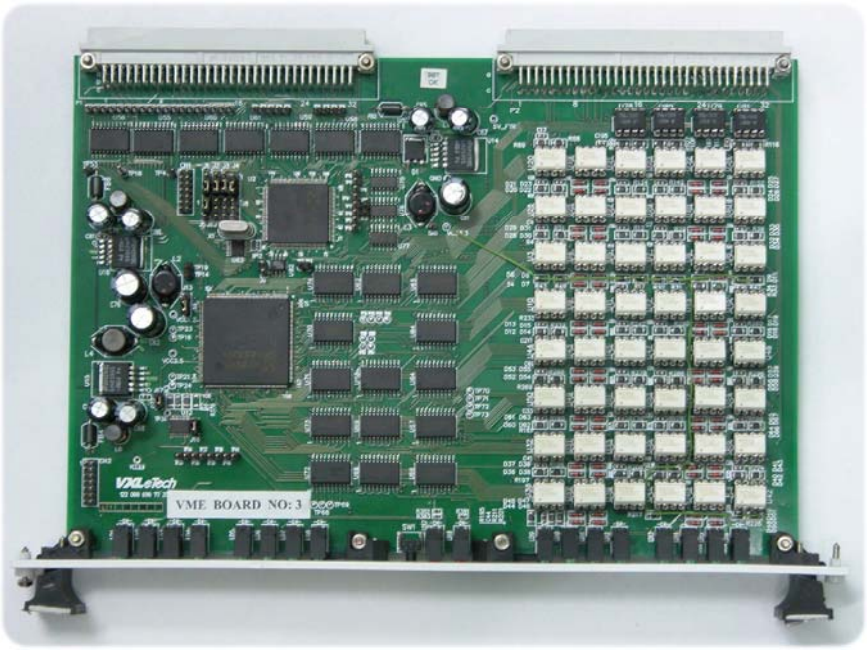
1. CPU Board
2. Ethernet Communication Board
3. Digital Input Board
4. Digital Output Board
5. Analog Input/Output Board
6. Protocol Translator Board
7. I/O Bus Backplane
8. Data Acquisition Board
9. Remote I/O Board

Presently, these boards are under various stages of development. Of these, Digital Input, Digital Output, Protocol Translator and I/O Bus Backplane Boards have been designed, fabricated and tested. These boards are now undergoing qualification tests for environmental conditions such as climatic, seismic and EMI/EMC.

The salient features of these boards are given below:

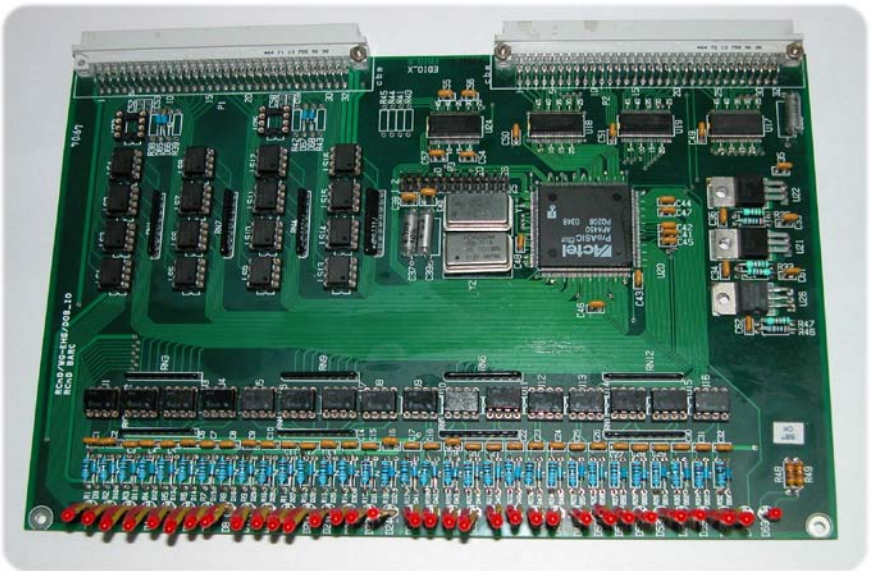
Digital Input Board

This board has been designed to accept 32 contact or voltage inputs. In addition to this, this board also accepts 8 pulse inputs. The field



Digital Input Board

inputs are galvanically isolated from the system using opto-couplers. The self-diagnostic feature in the form of Finite Impulse Test (FIT) on the digital input circuitry has been built as part of the board design. The status of inputs is reflected on the facia panel. The scanning of inputs and diagnostics has been implemented on a FPGA. Programmable features include demand scan, auto scan along with scan rate and de-bouncing on inputs. The bus interface logic for both VME and I/O bus has been implemented on a CPLD. A photograph of the Digital Input Board on VME bus is given above.



Digital Output Board

Digital Output Board

This board has been designed to generate 32 outputs. Solid state relays (with built-in isolation) have been used to generate the outputs. The outputs have a drive capability of 400 mA. As part of self-diagnostics, provision has been built on board to read back the outputs for verification. A special feature to output a programmable value upon detecting the main CPU failure has also been added. LEDs mounted on the facia panel indicate the status of outputs. The control logic has been implemented on a flash based FPGA and the bus interface (VME & I/O bus) is same as the one used in Digital Input Board. A photograph of the Digital Output board on I/O bus is given.

Analog Input/Output Board

This board has been designed in such a way that this board can be used either as Analog Input Board or as Analog Output Board. This board, when used as input board, accepts either 16 differential or 32 single ended inputs. Apart from this, it also accepts 4 test inputs for verifying the input circuit including the ADC. The inputs are digitized to 16 bit resolution. A quad DAC generates the test analog outputs that can be fed to the ADC for diagnostics purpose. In order to provide on-board isolation, the ADC and DAC data and control signals are

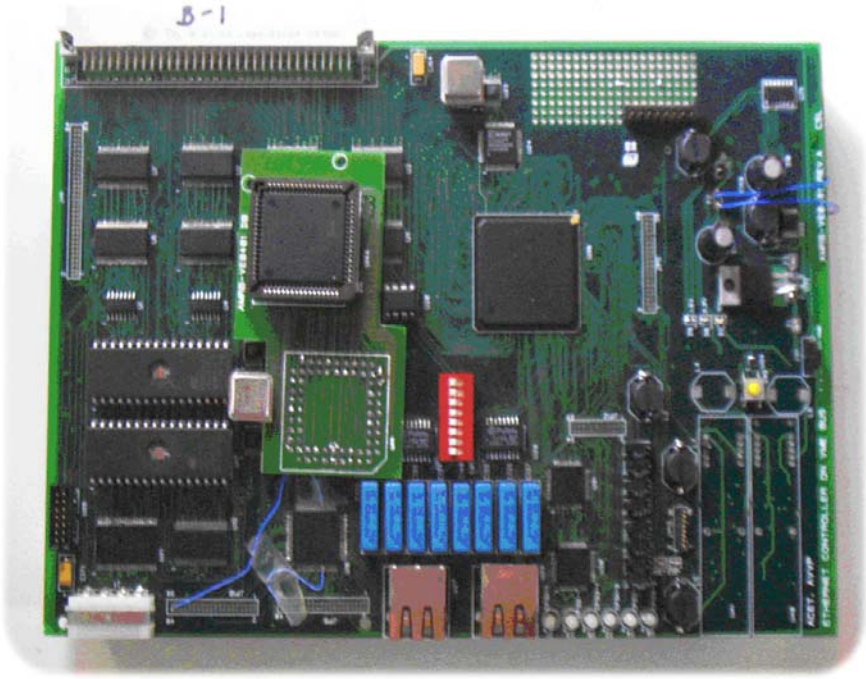
passed over opto-coupler link. The control logic has been implemented on a FPGA. The control logic allows inputs to be read either on DEMAND mode or on AUTO mode. In AUTO mode, either all inputs or designated inputs are read continuously at a regular interval or once upon a trigger. The trigger source can be pacer driven, external or through software control. Control logic checks each digitized input against two set points (Low and High) and provide the complete status to the main CPU. When this board is used as an output board, it provides 8 voltage outputs. Provision to generate pre-determined (failsafe) output upon detecting CPU failure is an added feature of this board. As part of self-diagnostics, these outputs are read back by the ADC for verification purpose. This board has been designed on both VME and I/O bus.

CPU Board

This board is based on 32 bit high performance processor operating at 600 MHz, with low power consumption. The board provides 128MB of flash memory for Operating System and user programs, 512MB of ECC protected DRAM, Real time clock and watchdog circuit along with 2 asynchronous communi-cation channels (RS232C), 2 synchronous HDLC/ SDLC 2.5Mbps communication (RS232C/ RS485) channels and one 10/100 Mbps Ethernet port. A four character dot matrix display on the facia has been provided for displaying system diagnostic information. Power-on self test and on-line self test are some of the other features built on board. An un-committed FPGA with hardware connection with DRAM and flash memory has been provided. An open-source Real time operating system is being planned for this board. The board is interfaced to VME bus using a standard VME bus master controller.

Ethernet Communication Board

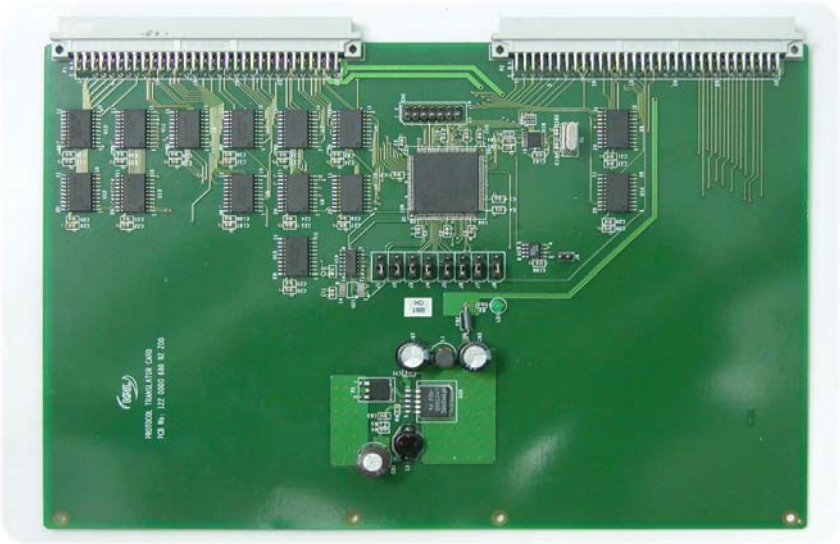
This is an intelligent board, based on VME bus, providing an additional Ethernet port for communication. The board provides dual link for communication. Of the two links, one acts as a standby for the other. Whenever a link failure is detected on the main link, the communication switches to the other link automatically. This feature has been implemented in hardware. It provides 10/100 Mbps auto negotiation for link speed. This board supports both full duplex and half duplex operation. The physical layer can be either copper or fiber optic cable. The complete Ethernet controller has been built in a FPGA. The interface between the host CPU and this board is through Dual ported 512KB of RAM.



Ethernet Communication Board

Protocol Translator Board

This board acts as an interface between VME bus and a proprietary I/O bus. The glue logic for the generation of I/O bus signals from VME bus signals have been implemented in a CPLD.



Protocol Translator Board

Data Acquisition Board

This board is primarily intended for embedded applications wherein the number of I/O signals is small. This board accepts 16 numbers of analog inputs and 8 digital inputs. Analog inputs are digitized to 16 bit resolution. The board generates 4 analog outputs and 8 digital outputs. While the digital I/O is isolated using opto-couplers, the analog I/O isolation may be achieved by off-board rail-mounted isolators. The control logic is being implemented in a FPGA. This board is being designed on both VME and I/O bus.

Remote I/O Board

This board is similar to the data acquisition board, described above, as far as the I/O specification is concerned. However, the control logic is implemented with the help of a micro controller with a built-in Ethernet network port. This board works in a stand alone mode and performs data acquisition function. The acquired data is transmitted over the Ethernet link to a computer for further processing.

Future Activities

Apart from these boards, a few more boards are envisaged for design. It includes an interface board for field bus connectivity, interface boards for fault tolerant system configuration, etc. It has been planned to build prototype systems with these boards for implementing system functions related to AHWR as part of XI Plan activity. Further plans are on to convert some of the designs that have been implemented in FPGA to ASIC.

GRADUATION FUNCTION OF BARC TRAINING SCHOOL

Bhabha Atomic Research Centre celebrated the Graduation Function day of the 48th batch of one-year Orientation Course for 96 Engineering Graduates and Science Post-Graduates (OCES) and 1st batch of four-months orientation course for 33 Engineering Postgraduates under DAE Graduate Fellowship Scheme (DGFS). Conceived by Dr Homi Bhabha and set up in 1956, 7384 officers have graduated to date from the prestigious BARC Training School.

The Guest of Honour for the function was Chief of the Army Staff, General J. J. Singh, PVSM and ADC to the President of India. In his address to the gathering of trainees and scientists, he remarked that our nation has to be self-reliant and strong to desire peace. He was happy to see twelve officers from all the the three wings of the armed forces graduating from our training school.

He expressed his confidence in their ability and said that these officers would be very valuable asset to the Armed Forces. The two main thrust areas for atomic energy are power generation and national security, which can be effectively met through the efforts of Department of Atomic Energy. He advocated global disarmament and

On the dais seen from left to right are : Dr S.P. Garg, Associate Director, Knowledge Management Group, BARC, Dr S. Banerjee, Director, BARC, Dr Anil Kakodkar, Chairman, AEC, Dr R.R. Puri, Head, Human Resource Development Division, BARC, Dr R.B. Grover, Director, Knowledge Management Group, BARC, and on the podium is the Guest of Honour Chief of the Army Staff, General J.J. Singh, PVSM and ADC to the President of India

Seated from left to right are Dr S. Banerjee, Director, BARC, Guest of Honour Chief of the Army Staff, General J.J. Singh, PVSM and ADC to the President of India, and Dr Anil Kakodkar, Chairman, AEC, with the Homi Bhabha Award winners

said NPT and CTBT are unequal treaties. He further added that our army is adept at imbibing advanced technology and has capability of fighting and winning during day and night.

Dr Anil Kakodkar, Chairman, AEC, in his Presidential Address, encouraged the Trainee Scientific Officers to pursue their career with dedication. He added that they should first

decide what is good for the country and then work hard to achieve the target of self-reliance and translate research into value of national importance. This will lead to many new technologies coming up on the horizon based on thorium utilization. He attributed the success of the DAE programmes to the human resource developed in the BARC Training School and therefore DAE is confident of pursuing programmes that have not been pursued by others.

Dr S. Banerjee, Director, BARC, also highlighted the success story of the BARC Training School and indicated that other important Institutions are emulating this concept. He congratulated the new batch of scientific officers on successful completion of the programme. He also emphasised the special bonding that this training engenders among the officers of a batch that contributes to the progress of programmes. Dr R.B. Grover, Director, Knowledge Management Group, BARC, welcomed the guests and mentioned the setting up of the Homi Bhabha National Institute under the aegis of DAE, with the status of a 'Deemed to be University' under the UGC Act, to conduct Post-graduate Degree Programmes.

The function concluded on a high note with the distribution of Homi Bhabha Awards by the Chief Guest. Dr R. R. Puri, Head, Human Resource Development Division, BARC, introduced the Homi Bhabha Awardees. These awards are given to the top ranking Trainee Scientific Officers of each discipline. A Vote of Thanks was proposed by Dr S. P. Garg, Associate Director, Knowledge Management Group, BARC.

भा.प.अ. केंद्र के वैज्ञानिक को सम्मान /BARC SCIENTIST HONOURED

श्री माओजीत बंध्योपाध्याय, रिमोर्ट हेंडलिंग एन्ड रोबोटिक्स प्रभाग, को डेवलोप्मेंट ऑफ एनडीटी (NDT) टेक्नीक्स फॉर इन-सर्विस इन्सपेक्शन ऑफ न्युक्लियर पॉवर प्लांट के विकास में प्रमुख योगदान के लिए इंडियन सोसाइटी फॉर नॉन-डेस्ट्रक्टिव टेस्टिंग (ISNT) मुंबई शाखा के द्वारा रिसर्च एन्ड डेवलोप्मेंट इन एनडीटी एचीवमेंट अवार्ड 2005 नामक पुरस्कार से सम्मानित किया गया। इन्होंने अल्ट्रासोनिक टेक्नीक फॉर फ्लॉ एन्ड मेटीरियल करेक्टराइज़ेशन के विकास के लिए व्यापक रूप से परिश्रम किया है। सुपर कंडक्टिंग केबल्ज़ एवं बीडब्लूआर एन्ड पीएचडब्लू आर कोर कंपोनेन्टस के विकास के लिए इनका योगदान उल्लेखनीय है।

Mr Manojit Bandyopadhyay of Division of Remote Handling & Robotics, BARC, was presented "Research & Development in NDT Achievement Award 2005" by Indian Society for Non-Destructive Testing (ISNT), Mumbai Chapter, for his outstanding contribution in the development of NDT techniques for in-service inspection of Nuclear Power Plants. He has worked extensively in the development of ultrasonic technique for flaw and material characterisation. His contributions in development of ultrasonic testing methods for superconducting cables and BWR and PHWR core components are noteworthy.

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