

India Makes the Grade in Supercomputing

by Radhakrishna Rao

QUIETLY and efficiently, India is set to make it big on the supercomputing front. The supersmart, versatile number crunching machines are no more the monopoly of advanced countries. The fully India designed and developed state-of-the-art Param-9000 supercomputer is available to users since March 1995. The second generation supercomputer which was on display at the supercomputing-94 exhibition held in Washington late last year was well received by the international IT (Information Technology) Community. According to Dr Vijay P Bhatkar, Director of the Pune-based Centre for Development of advanced Computing (C-DAC) which engineered this ultra smart intelligent machine, the display of Param-9000 in Washington Expo, one of the most prestigious computer exhibitions, has proved that India has the capability to develop supercomputers on a commercial scale. Says Dr Bhatkar: "This second generation Param machine with a peak computing power of

16 gigaflops initially can be further scaled up to 50-gigaflops on demand."

In a way, India's road to success in developing its own range of supercomputers was laid by the severe restriction imposed on selling of advanced Gray series of supercomputing machines to India. The US move to restrict the power of microprocessors and computers that can be made available to India was in retaliation to India's consistent refusal to sign the Nuclear Non-Proliferation Treaty and the Missile Technology Control Regime (AMTCR). While the US permitted the sale of Cray-X MP supercomputer for use by the India Meteorological Department (IMD) for its medium-range weather forecasting project with a number of conditionalities, it outrightly refused to clear the shipment of more powerful Cray-Y-MP machine to India. And it did not take long for India to initiate research and development work on the parallel processing architecture, which is

slowly gaining in importance in contrast to the vector processing featured in Cray machines. Even the Cray Inc. pioneer in vector processing computer technology — is now forced to go in for microprocessor based systems. Not willing to be a victim of the US whims and fancies, India in 1988 created C-DAC with the express objective of developing indigenous high performance computing systems based on parallel processing architecture. Along with the thrust on parallel processing, C-DAC also had the mandate to accelerate India's standing in the area of knowledge-based computing systems and the Very Large-scale Integration (VLSI) Technology. However, the immediate term goal of C-DAC was to design, develop and bring into commercial production an internationally competitive high performance parallel processing computer with computing power exceeding 1000-million M-flops. The sustained ground-

work done at C-DAC under the guidance of its Executive Director Dr Vijay P Bhatkar resulted in the unveiling of India's first-ever supercomputer christened, Param "Supreme" in the India classical language of Sanskrit by early 1990s. Essentially, the Param machine, which has wide-ranging applications, is based on transputer (a type of micro-processor) engineered by the Bristol-based firm Inmos. Both performance-wise and cost-wise, Param-9000 stands miles ahead of similar such machines in the world market. It carries a price tag of US \$4 million as against US \$10 million for machines of similar capacity in the global electronics market.

The Param series of supercomputers have nodes ranging from 16 to 254 with a peak computing power of about 16 gigaflops for its top-of-the-line system. Further, Param has a file storage system that can take up to 20-gigabytes. C-DAC has so far sold nearly two dozen of its Param

machines of varying capabilities. Significantly, Param-9000 features the innovative concept of heterogeneous parallel computing. The Bangalore-based India Institute of Science (IIS) and the Ahmedabad-based Space Applications Centre (SAC) are among the prestigious customers of the 8600 series of '64 node Param machines. In all, four machines have been exported to Germany, Canada and Russia after the Bangalore-based Indian Institute of Science (IIS) found Param to be flawless on completion of a rigorous check. Vijay P Bhatkar remarked, "C-DAC has gained very valuable experience out of this exercise and we are now confident that we can meet the requirements of supercomputing systems of the global clients." As it is, C-DAC is increasingly looking at the commercial market particularly for a data base applications, says a spokesman of C-DAC in Pune.

However, C-DAC is not willing to put all its eggs in one basket. As Dr Bhatkar has made it clear, the second Param will also incorporate pendulum, spare and T-9000 chips from Inmos. C-DAC is also not averse to getting Power PC from IBM for boosting the computing speed, versatility and flexibility of its machines under design. C-DAC sources say the future generation Param machines will have "processor independent" architecture.

Over the next five years, C-DAC hopes to achieve peak speed of one trillion floating point operations. Says a highly optimistic Bhatkar, "We are entering the field of frontier research. There are only three other competitors in the world: the US, a European consortium and Japan. But none of them has achieved a speed of trillion operations per second. Inter-

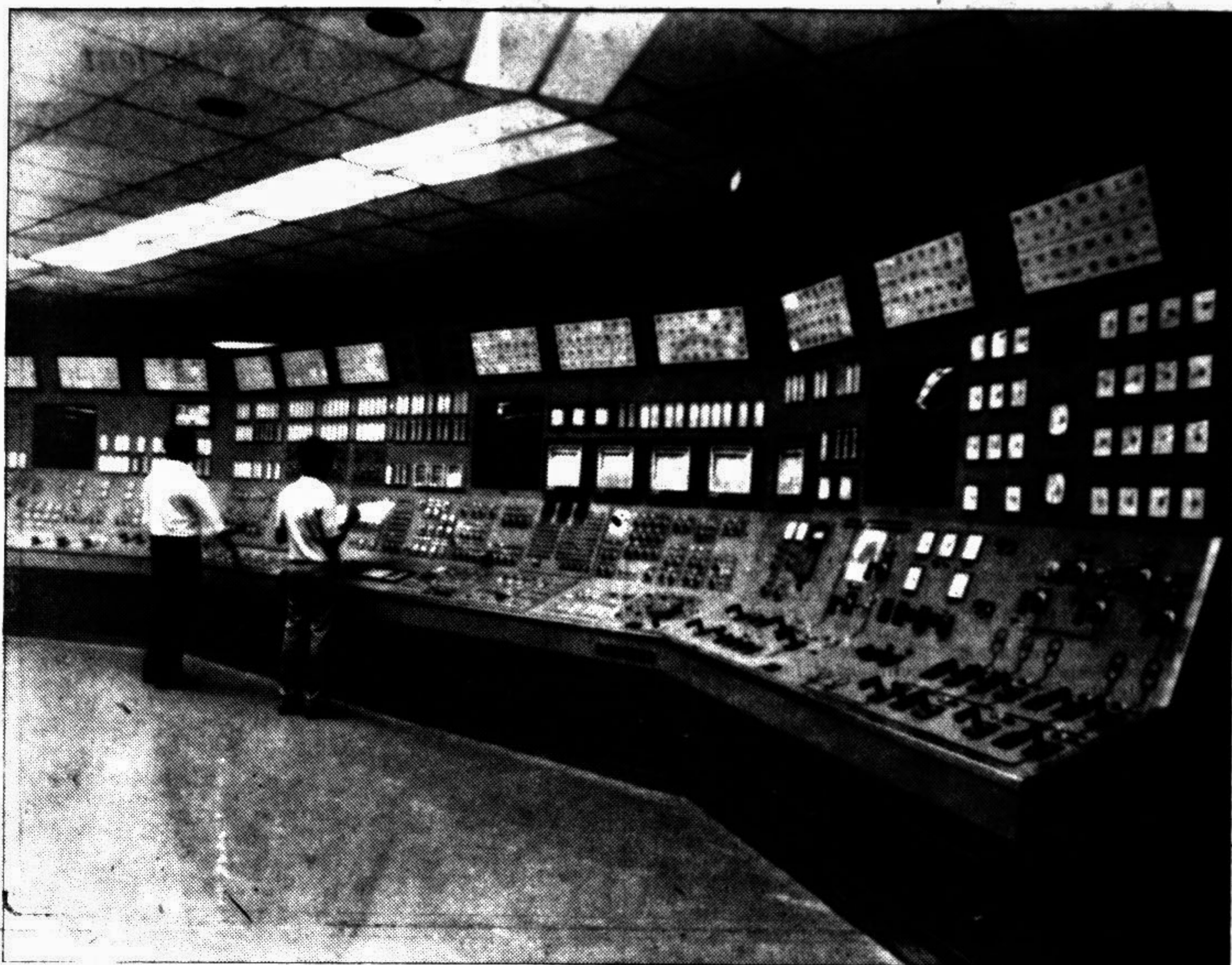
estingly the creation of C-DAC seems to have served as a catalyst for other Indian research and technology development organisations to come up with their own supercomputing machines. For example, the Bangalore-based National Aerospace Lab., (NAL) has developed a supercomputer christened Flo-solver. Based on the current generation 1860 microprocessor chips it can support up to five to eight nodes but is less powerful than C-DAC's Param series.

The Bhabha Atomic Research Centre (BARC) in Bombay has engineered its BPPS-64 parallel processing system based on 64 nodes. It is claimed to be more powerful than the fastest Param machines. Research and Development Organisation (DRDO) has unveiled its ANURAG supercomputer with 128 nodes. This is claimed to be the most inexpensive supercomputer of its class in the country.

Not to be left behind in the race for supercomputers, the Bangalore-based Centre for Development of Telematics (DOT) has come out with a transputer based supercomputer with all its PPS nodes running on the same algorithms on different sets of data. It can have up to 192 nodes.

Perhaps the big drawback in pushing ahead with the popularisation of supercomputers is the multiplicity of complex languages which render them difficult for networking. To overcome this hitch, the India Institute of Technology (IIT) in New Delhi is working on creating a flexible programme base for the supercomputers engineered in India so as to make them amenable to networking.

The author is a freelance source writer.
Courtesy — India Perspective



Computerised control room

Indian Software Goes Global

by Radhakrishna Rao

FROM being a low profile, slow moving, small time venture, the Indian software industry has graduated into a booming sunshine enterprise and a key foreign exchange earner for the country.

While during 1994-95, the Indian software exports fetched more than 500 mn dollars, in 1995-96, the software export is likely to fetch 1 bn dollars.

Boasting of an annual 50% growth rate since 1992, the computer software is poised to be worth 5 bn dollars industry in India by the turn of this century.

Currently India's domestic software market is estimated to be worth Rs 650 mn with more than 70 mn of companies providing a variety of services and packages to a wide ranging customers.

"Software market in India is booming today. It offers state of the art technology at relatively lower costs," says Dewang Mehta, executive director of the National Association of Software and Services Companies (NASSCOM). Mehta said it was the relatively low cost and excellent quality of the Indian software that attracted overseas customers to India.

"Just as the Gulf has its natural resources in crude oil and S Africa in diamonds, India's resources lie in its abundant technically skilled manpower and this transforms it into a software superpower," Mehta said this at an information technology exhibition held at Singapore

recently.

The Indian software sector progressed twice as fast as the US software industry between late 1980s and early 1990s.

Germany is today India's sixth largest software exporter. For the Germans, the transmission of software generated in Bangalore through satellite channels to various consuming points is an alluring proposition.

Many of the leading Indian infotech companies like HCL, wipro and PCL which are mostly engaged in providing services and solutions to clients in USA and western Europe have gone in for tie-ups.

The Rs 5000 mn ultra-modern software technology park (STP) set up on the outskirts of Bangalore jointly by the Singapore Information Technology Park Investment Pvt Ltd in association with Tata Industries and Karnataka State Industrial Development Corporation (KSIDC) provides a single hop satellite link to many parts of the US and Europe.

This state of the art STP is designed to provide tenants self-contained infrastructure and easy availability of power, water and communications. Units located inside the park do not need government and local agencies for the project.

The growth of this software technology park is the biggest success story in recent years far exceeding that of any export promotion zone in the country. — PTI Feature

Indian Space Programme

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establishing a sustained demand for products and service utilising the industry infrastructure to the maximum possible extent.

Recognising the need to promote India's foray into the space market, concerted efforts have been directed towards securing a breakthrough. A modest beginning was registered with successful completion of the study proposals and development of antenna for the INMARSAT-P hand held phone. Different versions of the antenna were also designed by Antrix, based on which successful field trials have been conducted by Inmarsat incorporating the special antenna designed by Antrix, thus opening up the possibility of operating the satellite voice connection to a cellular sized phone.

India's achievements in the development and application of space-based remote sensing technology has already drawn worldwide attention. A long-term agreement has been entered into with a US company, EOSAT, to distribute and market the remote sensing data from IRS constellation of satellites on a global basis. This has been a major breakthrough, where the synergies of two important organisations have

been combined for mutual benefit. With IRS-IC and P series to come, there is a very good market for the Indian Remote Sensing data products and value added services.

Leasing of Transponders
Another impressive achievement is ISRO's maiden venture of leasing out eleven transponders on the INSAT-2E to INSTELSAT, a global cooperative of 133 nations.

Antrix has begun to discuss with major satellite industries in the world for strategic alliances, as a principal subcontractor.

With proven and cost-effective systems available from India, it is expected that these discussions would soon result in concrete arrangements with some of the present world leaders.

With the successful launch of PSLV last year, Antrix/ISRO is now in a position to send low-weight communications satellites into low orbits at extremely competitive prices.

Considering that the global market for space products/services is of the order of \$ 10-15 billions per annum, it should be possible to tap at least one per cent of the existing market, to ultimately emerge as one of the market leaders of space business.

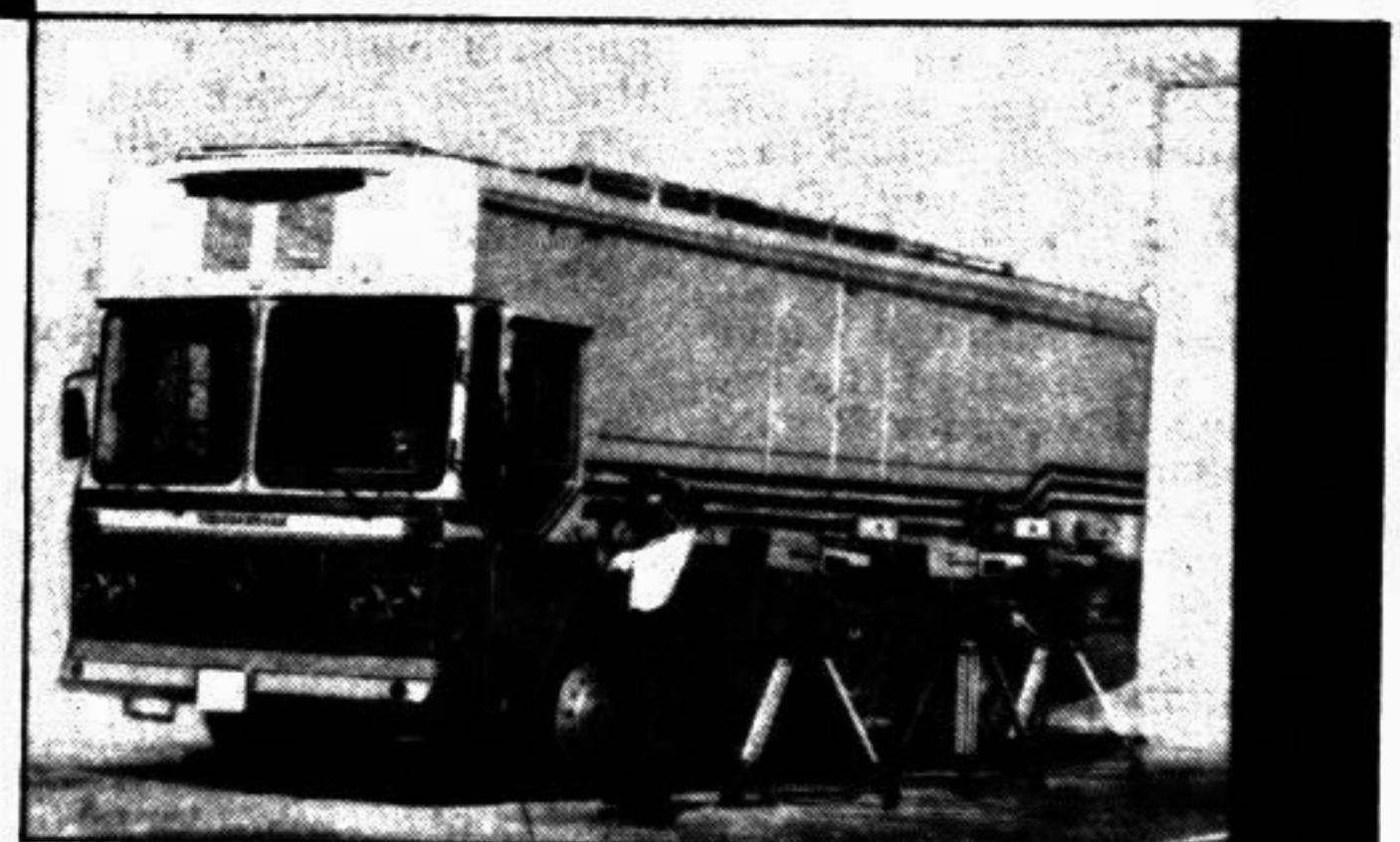
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