

## CASE STUDIES

### DR. J.S. RAO

#### Chief Science Officer, Altair Engineering India Pvt. Ltd.

Rao's career background can be better appreciated in a tabular form due to the length and breadth of his experience.

Experience	Time period
CEO, Dynaspede Integrated Systems, Bangalore	2004–2005
Chief Technology Officer, QuEST, Bangalore	2001–2004
Professor of Mechanical Engineering The University of New South Wales, Sydney, Australia	1996
NSC Research Chair Professor National Chung Cheng University, Chia-Yi, Taiwan	1994–1996
Professor of Mechanical Engineering Inst. für Mech., Gesamthochschule, Kassel, Germany	1988
Sr. Technical Consultant, Stress Technology Inc., Adjunct Professor Mechanical Engineering Rochester Institute of Technology, Rochester, NY, USA	1980–1981
Professor of Mechanical Engineering Concordia University, Montreal, Canada	1980
Professor of Mechanical Engineering Inst. Nationale des Sciences Appliquees, Lyon, France	1980
Science Counselor Indian Embassy, Washington DC	1984–1989
Indian Institute of Technology, Delhi Professor of Mechanical Engineering	1975–2000
Head of Mechanical Engineering	1981–1984
Head Industrial Tribology and Machine Dynamics Center	1976–1978
Professor of Mechanical Engineering Indian Institute of Technology, Kharagpur	1970–1975
Post Doctoral Commonwealth Fellow, University of Surrey, Guildford, England	1968–1970

It is really difficult to pick and put Rao's accomplishments on individual basis. But surely, with his interventions, the projects have achieved success. We are mentioning some of the greatest of his works.

With advances in solid model rotor dynamics and using the commercial codes such as Ansys, he worked as solver for rotor dynamics problems. He was able to attract considerable design work in Turbomachinery from General Electric in Schenectady and

Greenville in USA, Florence in Italy, GE Hydro in Norway and Pratt and Whitney from Toronto and Montreal in Canada and East Hartford, USA, MTU in Germany, Rolls Royce, England and other organisations.

He has made significant contributions to the Gas Turbine Research Establishment in the LP compressor design. He identified the root causes of the continued HP compressor blade failures over the last three years, and made further efforts to speed up the Kaveri design activities to make the engine for a Light Combat Aircraft.

Basic advances have been made to adopt ANSYS platform to perform solid rotor dynamics with nonlinear bearings, transient analysis, and stability and acceleration effects. This technology has been applied for advanced rotor dynamics analysis of Cryogenic pumps for GSLV fourth stage of ISRO. Rao also made significant contributions in the area of life extension of turbomachine components and began the design activity for aircraft wings for HAL and CEMILAC. For the contributions made, CEMILAC awarded certifying authority from private sector for the first time in the country for engine and frame of aircraft.

With Rao and other team members' efforts, some significant changes were brought in the stationary structures made for airframe ribs of a civilian aircraft Saras. The optimisation process gave a 26% decrease in plastic strain at critical locations and obtained four-fold life of the bladed disk fir tree roots under reverse flow conditions.

The world is now eagerly looking for fusion energy as a prospect of unlimited hazardous free source of energy just as that produced in stars. The liquid lithium cooling breeder, a tritium breeding module forming the heart of the fusion reactor designed recently by a dedicated team including Rao is approved by international organisation that would go into tests over the next few years.

The Indo-US sub-commission on Science and Technology was established in 1973. Over the years it has grown into a major bi-national program in the world. Initially the activities began with agriculture, then Health Sciences and continued into the areas of physical and chemical Sciences, environment and ecology, energy and other engineering areas. Science and Technology Initiative were taken by Mrs. Indira Gandhi and President Reagan in 1983 to consolidate these programs.

Vaccine Action Program was established in 1987. Agency for International Development has established recently two other major programs, viz., Project for the Advancement of Commercial Technology (PACT) and Project for Acceleration of Commercial Energy Research (PACER). Rao has been instrumental in developing these programs and continuing the ongoing programs good working relations and

close contacts are established with various US Agencies such as White House Office of Science & Technology Policy, National Science Foundation, National Academy of Sciences, Department of Agriculture, Department of Energy, Agency for International Development, National Institute of Health, Institute of Medicine, National Academy of Engineering, National Technical Information Services, American Association for the Advancement of Science etc.

The total commitment of both US and India then is over \$200 million spanned over nearly 250 projects for a three year period. A new program Ronald Reagan – Rajiv Gandhi Fellowship Exchange Program has just been announced.

In the area of Biotechnology, a Standing Advisory Committee consisting of Non Resident Indian Scientists was established to help the Biotechnology activities in India. Biotechnology Associate-ships have been introduced for special training at the US Universities and Laboratories. Workshops have been coordinated in India in this field. An industry workshop under the PACT program has been conducted in US with Indian and US industries participating to develop joint ventures. Rao participated in the panel of scientific advisers of the International Center of Genetic Engineering and Biotechnology and played a key role in the identification and selection of Director of the Center and Head of the Delhi Component.

Among other major responsibilities, Rao played a key role in the arrangements for the visits of the Prime Minister and Ministers of State for Science and Technology e.g., in arranging four different meetings with US Scientists to meet the PM in 1985. Arising out of these meetings with Non Resident Scientists, Joint Scientific Groups of Indian Scientists in US and India were established in Microelectronics and Aeronautics. Such groups in Biotechnology, computers and materials are being established.

These groups are playing a key role in India. In Microelectronics, they helped in identifying short and long-term projects and goals in the process of electronification of India. Arising out of the activities with Indian scientists in USA, a large number of export oriented US industries are set up in India, e.g., Texas Instruments, Commodore Computers, Data General, Indus Technologies etc. A data base of important Indian Scientists has been established.

One of the significant activities has been in the area of energy, both conventional and non-conventional areas. Information on clean coal technologies and efficient combustion procedures with fluidised and circulating beds and combined cycle power generation using coal gasification, magneto hydrodynamics etc. has been collected through various visits to develop programs with India. Rao worked on developing projects on Power plant Rotating machinery dynamics

with six different US universities and Indian Institutions. In the area of non-conventional energy, collaborative ventures between Luz International and Punjab Agro Industries have been developed for Solar Thermal Power Systems. Collaborative programs in Amorphous Silicon, Ocean Thermal Energy Conversion and other areas are under development.

A very highly successful science exhibition was organised in US. The exhibit was opened in 1985 in Chicago and it toured to Los Angeles, Portland, Seattle, Charlotte and Boston. A significant portion of this exhibit is retained in US with the American Association of Science Centers for touring at various places for another two years. This exhibit has projected a very visible and vibrant image of science in India to the US public in general. It continues to be very popular. Several conferences and Seminars were organised to highlight the recent progresses in various aspects of Science and Technology and the resultant impact on the improvement of quality of life in India. The interaction between the US and Indian museum scientific personnel has helped a lot in the science museum activity in India and also in the development of new programs of popularisation of science. Several new projects are developed or under development in various fields.

Programs of interaction of Indian Scientists of Association of Scientists of Indian Origin in America are being developed with several Indian Universities for exchange visits. Cooperation is also extended to the Council of Scientific and Industrial Research in identifying personnel for the Transfer of Knowledge through Expatriate Nationals Program under UN, to visit India. Another major activity has been to help Indian Scientists and Students who wish to return to India in finding the Pool positions of CSIR and appropriate jobs.

He has made significant contributions to R&D in the fields of Torsional Dynamics, Bending Dynamics, Blade Dynamics, Railway Train Consist Dynamics, Educational Technologies, Aircraft Engine Design, Optimisation, Conjugate Heat Transfer, Noise and Ventilation, Marine Propulsion and Space Structures.

He has attended over 100 national and international seminars, contributed in over 200 conference papers and more than 150 journal papers. He has 22 awards in his name. Rao has edited six books and written 15. Rao has been a part of 30 project works with the public organisations. Making numerous contributions to the scientific community, Rao is continuing to be involved in such activities. He is the founder member of the Association for Machines and Mechanisms. He is a member of many scientific bodies like American Society of Mechanical Engineers, Indian National Academy of Engineering,

Indian Society of Technical Education and United Children's Movement.

Rao says that the 360 Degree Feedback would help the planners in the country to have access of the scientific and technological pool developed in India. He holds the tool to bring out the potential leaders in the country who can add to the committed workforce and lead country to greater prosperity.