carrying out scientific experiments in aeronomy and astronomy, using rockets brought from outside. India's first sounding rocket was the small 75 mm diameter *Rohini*, RH-75. Today, India operates a family of sounding rockets of diameter ranging from 200 to 560 mm and capable of carrying up to 200 kg payloads to an altitude of 300–400 km to conduct scientific experiments. In February–March 2000, 45 rockets were launched on consecutive days, for a major scientific campaign, namely Equatorial Wave Campaign. Box 2 lists the history of several launch vehicles in India.

The GSLV project was initiated in 1990 with the objective of acquiring launch capability for geo-synchronous satellites. The first developmental test flight, GSLV, placed a 1540 kg experimental satellite, GSAT-1, in a geosynchronous transfer orbit (GTO). In its present configuration, GSLV is a three-stage vehicle. It is 49 m tall and weighs about 401 tonnes at a lift-off. The vehicle configuration makes use of several systems that have been flight-proven through India's Polar Satellite Launch Vehicle, PSLV.

In addition to the cryogenic stage, the other major new elements in GSLV are the liquid strap-on stages, a heat shield with larger diameter than PSLV (3.4 m compared to 3.2 m in PSLV) and the vented inter-stage between first and second stages. Mission design and simulations, realization of test and launch complex facilities, including servicing of cryogenic stages, launch hold and release mechanism, etc. were also involved in GSLV.

While the first developmental test flight was primarily intended for validating the vehicle design and its performance parameters as well as the associated ground infrastructure, the flight opportunity was also made use of to place an experimental satellite, GSAT-1, weighing about 1540 kg. Though the satellite could not be placed in the final geostationary orbit due to excessive propellant consumption during orbit raising operation and fuel shortage of 10 kg, it was used to prove new spacecraft elements like ten Newton Reaction Control Thrusters, Fast Recovery Star Sensors and Heat Pipe Radiator Panels to validate them before use in ISRO satellites like IRS and INSAT. GSAT-1 also carried two C-band transponders employing 10 W Solid State Power Amplifiers, one C-band transponder using 50 W Travelling Wave Tube Amplifier (TWTA) and two S-band transponders using 70 W TWTA. However, it may be difficult to conduct these experiments in its present orbit which is a 23 h orbit against the intended 24 h orbit.

FROM THE ARCHIVES

CURRENT SCIENCE

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The Indian Institute of Science

In view of the impending appointment of the second Quinquennial Reviewing Committee, a brief survey of the development and activities of the Indian Institute of Science, Bangalore, during its life of twenty-five years, may assist in creating sympathetic and enlightened public opinion. This will provide a favourable background, rendering the task of the Committee perhaps less tedious and more congenial; it may even be found indispensable to the formulation of a definite policy for promoting schemes of reform and expansion, such as the Committee may deem desirable to recommend on the conclusion of their labours. The first Quinquennial Reviewing Committee have, in more than one section of their report, drawn attention to the prevailing public ignorance of the work and resources of the Institute, and have also adversely commented on the general misconception among members of the Court regarding the economic activities of the different departments. Such ignorance and misunderstanding, if allowed to persist, would favour the growth of public prejudice affecting the character and fair reputation of the Institute, although there is ample testimony of honourable work steadily pursued in a spirit of disinterested service to the country. It is true that the Pope Committee reported in 1921 abundant evidence that there existed in many quarters 'a strong feeling of disappointment and dissatisfaction' with the then existing condition of the Institute; and if such a feeling still prevails in the public mind, it must be almost entirely due to general ignorance of the steps that have since been taken to remove partially or entirely the causes which led the Committee to record the adverse comment. If, however, there is still a source of dissatisfaction either within the precincts of the Institute or outside, we think it must arise from defects inherent in its organisation as well as from lack of a sound and definite policy, understood by all concerned, in regard to both the academic and the administrative spheres of this great foundation. In a short contribution on the Indian Institute of Science published in this *Journal* (October 1932), Alchymist observes that 'with this provision (resources becoming available) the future, to which we now look for progress and expansion at least comparable with those of the last fifteen years, is hopeful'. Manifestly the writer of the article is favourably impressed by the advances made by the Institute during this period in the different branches of its activity. Sometime ago it was pointed out in an article in *Nature* (April 29, 1933) that 'even if such an Institute were established in Great Britain, where the distances are not of the same continental order, it may be doubted if it would attract as many science graduates taking courses of advanced study and training for research as are now at Bangalore'. This is a disinterested testimony to the increasing popularity and sound reputation of the Institute.

The question of the status of the Institute is discussed by the Sewell Committee. They have stated 'that the Institute ought always to be in a position to provide such opportunities as cannot be obtained anywhere else in India; that it should do what no other institution can do; that it should maintain a position of pre-eminence; that it should acquire even a world reputation and that it should become a place of reference'. The path to attaining this ideal is also indicated in the report, viz. the personnel of the directorate, professoriate and staff, to which we would add finance. These admirable sentiments, however, are not in consonance with the theory elaborated by the Committee regarding the sources of revenue to be explored by the Institute. It seems to us that the preservation of the All-India or international character of the Institute depends upon the regional origin of its finances, its staff and students; and any suggestion of contribution by the provinces in proportion to the benefits received by their scholars must militate against the All-Indian status of the institution. On the other hand, contributions based on the financial capacity of each province irrespective of other considerations will invest the policy and outlook of the Institute with a national character. Each British Province and each major Indian State might endow a chair and support the laboratory attached. The late Mr J. N. Tata never contemplated personal or communal benefit from the Institute which his munificence founded. The Institute is the cultural rallying point of the Indian Nation, and its structure is an indivisible unit. If the provinces, the Indian States and the industrial magnates consider it their patriotic duty, rendered in a spirit of pure altruism, to create and support associate professorships, readerships and lecturerships in appropriate branches of science, then, it may be possible to release the funds of the Institute more freely for developing its international reputation, by inviting scientists of outstanding eminence such as the Sewell Committee, contemplate to associate themselves with the life and work of the institution. If it were only possible to induce such men to come to India – and it may not be difficult provided we have the resources – the universities, the government scientific departments and the industries would be glad to secure their co-operation and only then would the Institute be in 'a position to do what no other Institution could do'. It is gratifying that, with the limited funds at his disposal, Sir Venkata Raman has already taken the first step in this direction by inducing the Council to invite Professor G. Hevesy and Dr Max Born to stimulate the work of the Institute; further development of this great institution must depend upon the financial support of provincial governments and of the Indian States.

MEETING REPORT

Natural hazards: Mitigation and management*

The international conference on natural hazards held at the Guru Nanak Dev University, Amritsar was followed by a two-day field trip to the Kangra valley, Himachal Pradesh and the site of the 1905 earthquake of magnitude 8.0 which killed about 20,000 people. This international conference was sponsored by Natural Disaster Management Division of Ministry of Agriculture and Department of Space, Govt. of India. The conference was significant and relevant in the context of the occurrence of Bhuj earthquake in Gujarat in January 2001.

The conference attracted 20 foreign and 70 Indian delegates from 12 countries. In all, 75 papers were presented in 10 technical sessions and one poster session. The main themes of the conference were earthquakes, landslides, cyclones, floods and natural radiation hazards. The maximum number of papers was presented on the topic of earthquakes and their hazards.

Roger Bilham (University of Colorado, USA) delivered the keynote address on the topic, 'Future great Himalayan earthquakes'. His conclusions were based on GPS studies carried out by him in the Himalayas during the last decade. According to Bilham, 60% of Himalayan arc has enough stored elastic energy to drive 5–8 great earthquakes of magnitude 7–8 or even more. He also analysed the aftershock data from the Bhuj quake and discussed the causes that were responsible for its occurrence. According to him, the region around Ahmedabad is in the zone of enhanced compressive stress. R. K. Bhandari (Natural Disaster Management Centre, Chennai) highlighted the need for a national natural disaster knowledge network (*Nanadisk-Net*) for India. The government has constituted a high-powered committee to address the multiple facets of natural disasters in India. Access to global databases and global early warning systems will also be facilitated in a big way, according to Bhandari.

Vinod K. Gaur (CMMACS, Bangalore) spoke about disaster mitigation through risk assessment. His paper stressed the dangers of increasing vulnerability of a fast-growing population in developing countries to natural hazards. Assessment of risk is a key element in disaster mitigation. It was argued that a Disaster Mitigation Act be legislated by the Parliament to provide a framework of policy and planning. Ramesh P. Singh (IIT, Kanpur) highlighted the role of remote sensing in mapping and monitoring of natural and man-made disasters. Thomas Streil (SARAD GmbH Co., Germany) presented the results obtained by Earthquake Precursor Observation System (EPOS)1-A multiparameter measuring system developed for earthquake prediction research. EPOS can monitor up to 17 precursory parameters at one spot in groundwater. It is being tested in Mexico and Germany.

*Report based on the 'International Conference on Natural Hazards: Mitigation and Management' organized by Guru Nanak Dev University, Amritsar from 12 to 15 March 2001.