

## NAL-UNI Course on Software Engineering

The 11th course in the NAL-UNI Lecture Series, on *Software Engineering for Mission/Safety-Critical Systems*, opened at the TS Seminar Hall on 18 March 1998. 26 participants from R&D establishments (ADA, BARC, C-DOT, ISAC, VSSC, NRSA, LRDE, DRDL, CABS and ITR) and industry (Daimler Benz, Calyx Software) attended the 3-day course being delivered by a faculty which includes A Pedar (Course Coordinator) and J Jayanthi (NAL), K Karunakar (ADA), Y N Srikant and V V S Sarma (IISc), Vijay Rao (CASSA) and Kanchana Gopinath (CABS). As is customary, NAL Director Dr T S Prahlad welcomed the participants (but where was Dr G Prathap, Convener, NAL-UNI Lecture Programme? -- a traffic snarl-up just outside the NAL entrance briefly frustrated Dr Prathap, who was returning from Kharagpur by the morning flight). In his opening remarks, Dr Prahlad talked of the pivotal role played by software in aerospace programmes ("we are currently undertaking aerospace projects worth about Rs 5000 crores in India, and their fate will, in considerable measure, be decided by the quality of software which goes into these programmes"). Dr Prahlad also recalled the many "debates and discussions" at ADA on software and said "there is no real foolproof method for fully certifying software; some elements of risk analysis are always involved". The NAL Director closed his remarks by expressing the hope that during the NAL-UNI course "Dr Pedar and his colleagues will throw more light on the methodologies involved to make software as safe as possible". Dr Pedar then opened the lecture series by giving a masterly overview of software engineering. "Software", he explained, "plays a dual role: it is both a *product* and a *vehicle* to deliver other products". In his brief historical review of software (which he also defined as a 'transformer of information'), Dr Pedar recalled the days (up to 1970 or so) when program writing was thought more to be an art, with accolades being reserved for the programmer "who reduced a 200-line program to 100 lines". "We have come a long way since then", he said, "and it is not unusual to encounter a program with a million lines of code today". Dr Pedar also discussed issues involved in software management, software process models and talked of the constantly increasing demands on the software engineer ("we demand failure rates of  $10^{-9}$  for civil aircraft and  $10^{-7}$  for military aircraft"). He also talked of the widening scope of software solutions (from medical instruments to railway signalling systems) and the associated responsibilities ("we can't have medical instruments which kill people!"). The only way out, Dr Pedar said, "was to adopt a disciplined engineering approach to software development".

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