

[#IP568 /28 July - 3 Aug 2003](#)

NAL is 44

NAL's Foundation Day function (NAL was founded on 1 June 1959) was held on 29 July this year. Mr N Vedachalam, Director, Liquid Propulsion System Centre (LPSC), Thiruvananthapuram delivered the 17th NAL Foundation Day lecture on *Challenges in cryogenic rocket propulsion*. Ms Padma Madhuranath, Flight Mechanics and Control Division, delivered the NAL Technology Lecture on *Air traffic management and simulation*.



Dr R V Krishnan, Adviser (M&A) and Head, Materials Science Division, welcomed the gathering (as always, there wasn't a single

vacant seat in the S R Valluri Auditorium) and paid a rich tribute to NAL's former Directors ("the foundations that they laid have stood the test of time"). Dr Krishnan also announced that teams at NAL's Flight Mechanics and Control Division have won the 2003 CSIR Technology Shield in Engineering Sciences. Mr Vedachalam's hour-long lecture proved to be a richly deserved tribute to ISRO's GSLV programme. It was a compelling narrative that covered wide ground: the merits of liquid propulsion systems (higher specific impulse, longer burning duration, multiple start and stop capability, precise guidance termination etc.), the design concepts in GSLV development, the critical materials, the test facilities and the future challenges. Mr Vedachalam's presentation also contained some truly remarkable video clips: GSLV Mk2's flawless lift-off and the dramatic moment when the engine successfully completed a 1000-second run.

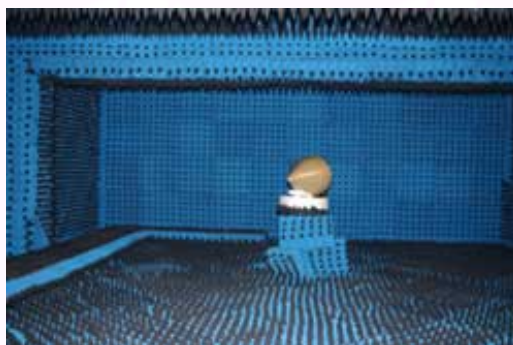
In his presidential remarks, Dr B R Pai, Director, thanked Mr Vedachalam for his "delightful

Certificate obtained for NAL Microwave Anechoic Chamber



The NAL *Microwave Anechoic Chamber* (NAL-MAC) has been certified following extensive chamber validation measurements carried out over last two months. The relevant papers were formally handed over to Dr B R Pai, Director, NAL by Prof. PR Mahapatra, of IISc Bangalore.

NAL-MAC is contemplated for accurate antenna and radome measurements as well as monostatic and bistatic RCS (stealth) applications. This facility of the *Computational Electromagnetics Laboratory* (CEM Lab., ALD) has been designed and fabricated in a record time of less than three months. The overall dimensions of the shielded NAL-MAC are 10.5 m x 7.3 m x 3.1 m, with the large operational quiet zone (QZ) of 3 m x 3 m x 1 m (sufficient, for example, for a 2.5m radome).



The chamber reflectivity at, better than 60 dB (down) in the operational frequency range of 4 to 40 GHz (extended range: 2 to 4 GHz, 40 to 50 GHz), is of international class. A unique feature of NAL-MAC is that it is completely indigenous.

At the Aerospace Electronics and Systems Division (ALSD)



I am at ALSD with Mr N N Murthy and his extremely hard-working and capable teams. ALSD is a pivotal player in the SARAS programme; the SARAS avionics and electronics, in particular, is entirely the Division's responsibility.

The Division has completed the development of two test rigs for SARAS avionics integration testing. All sub-systems have been thoroughly

lecture" that explained liquid propulsion systems so lucidly ("we weren't aware of all these intricacies"). Dr Pai (braving a bad throat) also briefly described NAL's R&D highlights during 2002-03. The NAL Director then invited his LPSC counterpart to release NAL's annual report for 2002-03, and give away the NAL Foundation Day awards in various categories.



Ms Padma Madhuranath's talk was a wonderful introduction on air traffic management (ATM):



she traced the history of air traffic control, developments in America and Europe and the challenges that lie ahead of ATM R&D

teams in India. The lecture also described a modelling and simulation experiment conducted at Bangalore airport ("the airport is capable of handling today's traffic densities, problems could start if traffic increases by over 50%").

Dr S Ramamurthy, Head, TS, proposed the vote of thanks. As always, TS had organized the function very well.

- [Annual Report bundle](#)
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tested on the ground rig and demonstrated to the certifying agency (DGCA). All electrical systems have also been tested (and cleared by DGCA) on a specially developed test rig at HAL, Lucknow and on NAL's engine test bed.

Mr Murthy and his teams tell me that the development of the master and slave units for flight test instrumentation is nearly complete. As I look around, I find groups busy installing the cable harness on the aircraft; continuity and other checks are planned for the next fortnight.

It's going to be very hard work for these teams in the weeks and months to follow - but ALSD has been working for SARAS at this pace for many years now!

R Guruprasad

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|  | | SARAS Bundle |
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| <p>SARAS</p> <ul style="list-style-type: none"> • Limit load test on stub wing-engine mount of SARAS aircraft • At the Sheet Metal Shop • At the Metrology Department • engine-run • The SARAS flap functionality tests • A quiet morning at the C-CADD hangar • DG-CSIR witnesses the SARAS engine run • SARAS engine torque attains 100% • Structural static testing of SARAS outboard • At the SARAS hangar : 18 December 2003 | <ul style="list-style-type: none"> • SARAS asymmetric power ground rolls • First SARAS experimental flight successful • The SARAS telemetry real-time monitoring team • SARAS's Jewel Boxes SARAS flight conversation between the pilot, the ATC control tower the Test Director and the Chase Aircraft recorded in the SSCVFDR - Audio clip , Video clip |
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[#IP567 /21-27 July 2003](#)

No one can replace Raman



The news of Raman's passing away came like a bolt from the blue on the morning of 16 July 2003.

We were together till noon the previous day. We discussed issues related to quick fabrication of flight models using rapid prototyping methods and investment casting. Later, we converted a 3D CAD model, which I had received from VSSC, into a solid model.

We split for lunch agreeing that we would develop the solid model further the next day. Raman left for VITM after lunch to work on his pet project to build the Wright Brothers' Flyer. The next day, Raman was no more.

I cannot think of any person as talented as Raman.

At the Propulsion Division



We are at the Aeroengine Test Facility of the Propulsion Division. The SARAS power plant PT6A-66 along with the nacelle is being tested here.

It is necessary to test the nacelle design to ascertain if all the flows, pressures, temperatures and vibration levels are within allowable limits as prescribed by the engine manufacturer and the nacelle structural designers.

The whole team is present and eager to start. This will be the final test before the engine is mounted on the SARAS aircraft. About 40 runs have already taken place. The engine nacelle combination was tested for normal run ups, reverse thrust, propeller pitch change response, slam and many more such tests. Three pilots: Wg. Cdr. Ashoka, Sq. Ldr. Venugopal and Sq. Ldr. Malik also ran

Descriptions such as 'painter', 'photographer', 'sculptor', 'aviator', 'aeromodeller', 'music enthusiast', 'scientist' and 'writer' would all have fitted him. One of his aircraft paintings was on display at the Experimental Aircraft Association's Museum in the USA for a full year!

Raman loved air shows, you could see him walking around at air shows with real and unbridled joy. His alert camera missed nothing; in fact his photographs of the *Surya Kiran* aerobatics were so impressive that the chief of the squad invited him to spend time with the entire flying crew. I also remember the time when I was at DLR, Goettingen in 1989-1992 and my German colleague Herr Heddergott showed me a splendid sculpture of the smiling Buddha. Behind the smile -- and this didn't surprise me at all -- were Raman's gifted hands.

Raman was my partner when we initiated powered hang gliding in NAL during 1988-89. In fact, Raman was the first man in NAL to fly the Altair. The kite took off at the IISc airstrip with Raman as solo pilot, climbed about 20 ft., stalled and came crashing to the ground. The keel broke and had to be replaced. Of course, Raman was unhurt and smiling.

Raman learnt flying the Pushpak and Aeronka airplanes at the Government Flight Training School, Jakkur, under the studentship of Captain Pinto. Later, he even obtained a PPL from the DGCA. We flew together in both the airplanes many times, with Raman at the controls. Raman was very fond of demonstrating the stall, and would often tell me that's how "Neddy the Nut with his Old Model T" (Walt Disney's *Absent Minded Professor*) would stall.

As an aeromodeller, Raman loved to cast scaled static models; I remember the fantastic response to his models in an exhibition at the SED auditorium in the mid 80's, with even Prof. Narasimha warmly congratulating him. Raman had exhibited his models in USA and won accolades there as well.

Raman's other loves included steam locomotives, vintage cars (he actively participate in vintage car rallies) and playing the piano. He had a very wide reception band for music. He enjoyed listening to Beethoven, Mozart, Brahms, Lucieno Pavarotti and M S Gopalakrishnan. I once lent him an album of Richard Clayderman, a contemporary French pianist. He fell in love with this album so much that he


the engine to check its response and performance. Mr. N N Murthy and his team designed and commissioned the data acquisition system and collected valuable data from various sensors strewn in the nacelle.

Mr. S Prakash and Dr. P K Dash instrumented the engine yoke and managed to get a wealthy "strain value" database.

Mr. S U Khan of Deccan Aviation, with his wide experience, also guided the team in fine tuning the engine and successfully rigging all its controls.

The test is successful. Mr. M S Chidananda and his team are totally satisfied with the engine and nacelle performance. The SARAS team has passed another test.

R Guruprasad



[SARAS Bundle](#)

- At the SARAS hangar
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- At the Propulsion Division
- At the Aerospace Electronics and Systems Division (ALSD)
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- SARAS wing static test

contacted Clayderman, met him once at a music shop on Brigade Road and even got his autograph. While in Goettingen, where he worked on the development of an adaptive wall wind tunnel, Raman was a regular visitor to the Jacobian Church choir. One was also sure to meet Raman in most classical Hindusthani and Karnatak music concerts in the city.

Raman was a regular contributor to *Kanaada*, the science journal published by NAL. He wrote *Vichitra Vimanagalu* primarily for high school children in



Karnataka, gave talks on All India Radio and worked in a million other ways to spread the aerospace gospel. One of his recent passions was to organize a variety of contests to coincide with the centenary year of powered flight. He was really looking forward to 17 December 2003. How unfair that Raman can't be around to celebrate the splendid achievement of the Wright Brothers.

Despite being knowledgeable in so many areas, Raman never showed off. He was quite an introvert who would speak only when asked to. He never discussed his problems with any one and remained within himself. Raman was my schoolmate at National High School; later we were roommates and colleagues in NAL for more than 18 years. We therefore shared a lot of our life together. Now I must learn to live without him! I shall always cherish the sweet moments of my interactions with him. No one can replace Raman.

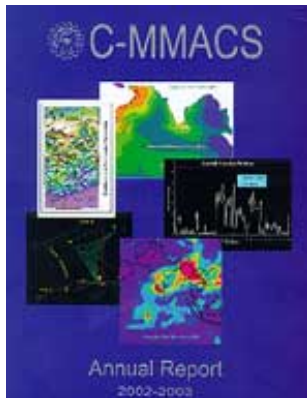
G K Suryanarayana

[K S Raman's tribute to Usha Sundaram](#)
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[#IP566 /14 - 20 July 2003](#)

C-MMACS turns 15



The C-MMACS Foundation Day function is a special event. It is always celebrated on 15 July ("because C-MMACS was actually founded on 15 July 1988") and things are deliberately kept very simple. There is a brief welcome

speech by the Scientist-in-Charge (Dr Gangan Prathap, since April 2000), an equally brief presidential address (usually by the NAL Director; in his address on Tuesday, Dr B R Pai complimented C-MMACS for "carving a very special niche in mathematical modelling and computer simulation" and for "venturing into areas that others have still not got into" and advised C-MMACS to ensure that undirected research remains well supported) and then the day's main event: the C-MMACS Foundation Day Lecture.

This year's Foundation Day Lecture (eighth in the series), was delivered by Prof V B Kaujalgi of the Indian Institute of Management (and an old friend of C-MMACS right from its inception). Prof Kaujalgi spoke on *Performance and Evaluation of R&D Institutes*.

The lecture was thoughtful and enjoyable. "All exercises relating to performance evaluation are difficult, and evaluating the performance of R&D labs is arguably the most difficult", he said. Prof Kaujalgi indicated six factors that would be critical in such an evaluation: good R&D

Professor Narasimha is 70



It is a special pleasure to greet Professor Roddam Narasimha (RN) as he turns 70 on 20 July 2003. We wish him many more years of accomplishment, scholarship and good health.

[The \(convective\) lure of the tropics](#)

[Verses for the Brave](#)

[Modelling and Simulation of Fluid Flows: Some Examples](#)

[More Verses for the Brave](#)

[Prof Narasimha's 'birthday lecture' on Fluid dynamics research -- 10 years from now](#)

[An affectionate tribute to Ludwig Prandtl](#)

[Divide, conquer and unify](#)

[Monsoon Raagas](#)

[The Flosolver programme is 20 years old](#)

K S Raman's tragic departure



K S Raman, Sc F and Deputy Head, NTAf, passed away on 16 July 2003 at about 7.15 in the morning. Raman was getting ready to leave for office when a massive heart attack ended his life. He was just 48.

Dr G K Suryanarayana's tribute to K S Raman will appear next week.

[K S Raman's tribute to Usha Sundaram](#)

[Etched in memory \(AVIA Dec 02 page - 7\)](#)

[No one can replace Raman](#)

planning, identification of market needs, effective technology transfer to the industry, selection of proper financial criteria for evaluating R&D worth, good 'man management' and good team work. The most likely reasons why evaluation systems fail, he explained, are: too much emphasis on internal measurements and the absence of an appropriate 'quali-quantitative' index to measure performance.

Prof Kaujalgi's lecture was laced with wise, pragmatic and witty observations. Samplers: "There are two big buzzwords in management today: 'strategic planning' and 'people management'; everything else seems to revolve around these two factors". "I don't mind saying this at C-MMACS: the mathematical abilities of management experts is rather limited". "All these rankings of colleges and management schools that you read in magazines are not above suspicion; many are commercial and very controversial". "The innovative output of an institute is directly proportional to its quantum of basic research".

Prof Kaujalgi ended his lecture with a SWOT analysis of C-MMACS. After the lecture the other events followed in quick succession: release of the C-MMACS annual report for 2002-03, presentation of shawls to the chief guest and president and the vote of thanks by Dr P Goswami. As always, it was wonderful to meet Prof V K Gaur, Dr K S Yajnik and other elders at the function.

[List of C-MMACS foundation day lecture](#)

Remembering Raman

The multi-dimensional man of NAL

Structural test certification



This week I am at NAL's Structural Integrity Division (SID). SID's responsibilities for the SARAS programme include structural testing of the wing, fuselage, fin and horizontal tail (HT) and damage tolerance evaluation

of the airframe.

As I enter I see that the static testing of the SARAS fuselage is going on (the flying wing test is already over). Six load cases have been identified for first flight clearance: (a) two-point normal landing, (b) two-point landing with spring back, (c) balanced flight condition, (d) unchecked manoeuvre case, (e) nose landing gear, yawing and towing and (f) power spectral density.

My colleague K E Girish of SID says that tests (a)-(d) are over. "We're completing the last two tests of the series", he tells me. The mood is upbeat. "There's a lot of work ahead, but we'll surely get there!", Girish and other colleagues tell me.

R Guruprasad



[SARAS Bundle](#)

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[#IP565 /6 - 13 July 2003](#)

At the SARAS hangar



I am at the SARAS hangar with P Ramakrishnan. The hangar is actually very large; but it looks small with the SARAS inside and all the on-going activity.

The fuselage structure is completely ready. The wing too is completely ready. The wing-fuselage coupling has been completed, and the integration of all the fairings and empennage is over.

The equipping of the SARAS fuselage with the fuel system, environment control system, cabin pressure control system, oxygen system and fire extinguishing system has been completed.

As I look around I find that the installation of the hydraulic system line replacement units (LRUs), pipes and hoses is under progress. Installation of looms for avionics and electrical systems is going on.

"We will start aircraft level tests of the flight control systems next week", Ramakrishnan tells me.

I prepare to leave, but no one else in the hangar can hope to leave. They'll keep working day in and day out. Till SARAS takes off.

R Guruprasad



NAL's annual reports



NAL will soon be 44 years old and,

starting with the 1960-61 report, NAL's annual report has been published every year without a break. The early reports were slim, with plain cover pages, and just a handful of photographs; probably NAL's first Director, Dr P Nilakantan, simply dictated the reports to his capable stenographer.

As NAL's activities grew, its annual reports also grew proportionately. It became harder to put together these reports. Of course, like all annual reports, NAL's reports too were wonderfully unreadable. They contained a wealth of information, data and pictures, but nobody was supposed to - or wanted to - actually read them.

In the mid-1980's, Prof R Narasimha (RN) tried to change things, and he was reasonably successful. Certainly the first chapter - that he wrote himself - was eminently readable. The chapter contained news, identified the major R&D successes, spoke of future plans and was

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profusely illustrated. RN also established the practice of releasing the annual report on NAL's Foundation Day.

This tradition continues even today; NAL's annual report for 2002-03 will be released on 29 July 2003. The annual report now is extremely voluminous with 240 pages, over 300 illustrations and text packed tightly in three-column layouts. It could be argued that we are writing too much in these reports - especially since nobody probably reads these reports even today. But writing too much may not be such a bad thing, especially when we can so easily archive such reports digitally now. There's actually a lot of good work going on at NAL, and our annual reports must ensure that this work is adequately recorded - for posterity, if for no other reason.

[Annual Report Bundle](#)
[NAL Annual Report cover pages](#)

Seventeenth NAL Foundation Day lecture

The title of Mr N Vedachalam's seventeenth (not sixteenth, as reported last week) NAL Foundation Day lecture, to be delivered on 29 July 2003, will be "Challenges in cryogenic rocket propulsion".

[List of NAL Foundation Day Lecture](#)



Dr Sridhara Murthy's distinction

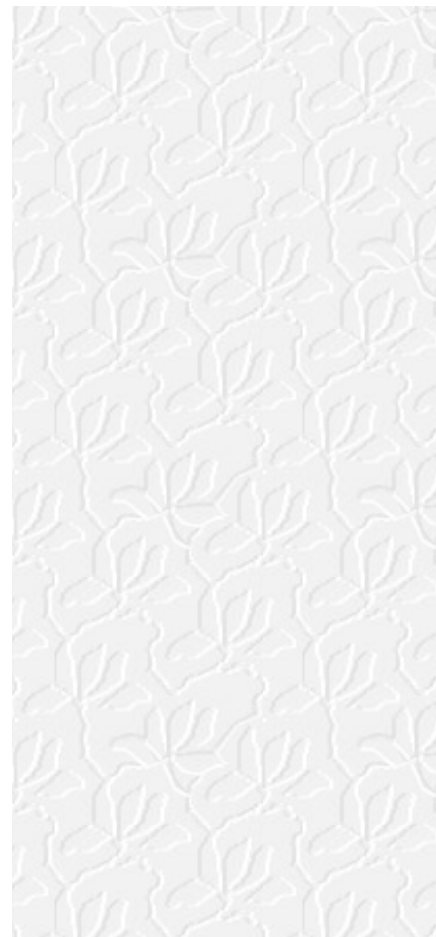


Dr S Sridhara Murthy, Structures Division, has been elected a Fellow of the Aeronautical Society of India (AeSI) at the Society's Council meeting held recently at Chandigarh.

HANSA and Swati

In its early days it was believed that NAL's HANSA aircraft would have to compete with the Swati aircraft in the flying club segment. With Swati no longer flying, there is really no contest now. But it was still interesting to meet Ms Sini Vasudevan of the Trivandrum Flying Club who has flown both the aircraft. Sini was all praise for HANSA's flying performance and readily agreed that HANSA was more fun to fly than the Swati. "HANSA's controls are more sensitive and its climb rate is far, far better", she said. Sini was also very happy with the visibility from the HANSA cockpit, "although getting in and out of the cockpit could have been a little more comfortable".

[HANSA Bundle](#)



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