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STRUCTURES DIVISION

SUMMARY

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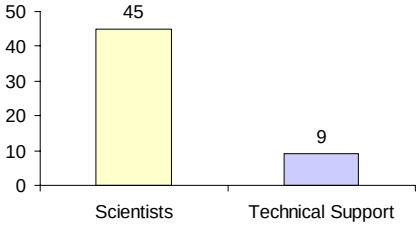

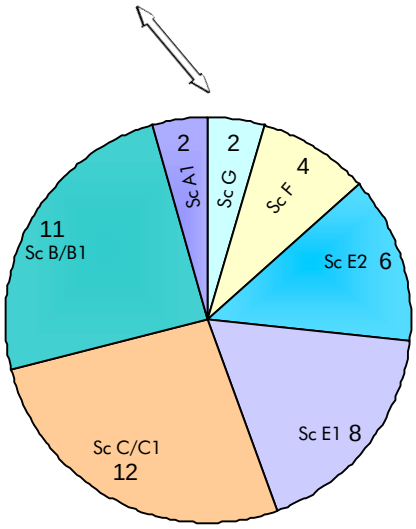

The activities of the Structures Division during the year were directed towards the Laboratory's major project, SARAS, and other R&D areas like smart structures for vibration and flutter control, development of airborne FRP and ceramic radomes, structural weight reduction through optimization and study of nonlinear phenomenon like bird impact on aircraft components. The most significant events of the year are:

- Installation and commissioning of an indigenously designed and built 4m x 8m autoclave for composite components at HAL, Bangalore, and
- Successful completion of final phase of aeroelastic testing of LCA wing models with R73E missile.

Structural analysis of SARAS components continued with revised loads. Equivalent test loads were generated for wing and control surfaces and the analysis repeated for these loads. Detailed analysis was carried out for the wing taking into account the presence of cutouts based on notch strength analysis methodology. The wing-fuselage belly fairing of GFRP was analysed and the design finalised. An integrated analysis of SARAS with wing-fuselage-empennage combined was repeated with revised balancing loads. The FEA results were correlated with test results for the elevator. Bird strike studies on control surfaces using MSC/DYTRAN were pursued for the HT of SARAS to assess the extent of damage. Several documents on stress analysis have been released for the purpose of stress clearance.

The design of constant and variable thickness ceramic radomes was completed and the radome fabrication is in progress. As part of the design exercise, two computer codes were developed: one for material characterization of ceramics based on the Weibull model and the other for reliability analysis of ceramic components based on both principle of independent action and shear sensitive models. Structural design of GFRP radomes for the maritime Jaguar aircraft was completed and the development of GFRP radomes for the TU-142M aircraft for the Indian Navy was initiated. The TDF antenna radome design has also been completed.

As part of the forward-looking research, further studies on error analysis in FEM continued. The projection theorem in function space was adopted to explain shear locking in the Timoshenko beam FE. The Timoshenko beam model was used to determine the dynamic characteristics of the SARAS wing. Assessment and performance evaluation of the element library in the FINESSE FEM package of ADA was successfully completed. Bench marking of elements for non-linear behaviour in NASTRAN and ADINA was completed. An architecture based on KBE is being developed to automate the routine design of structural components of the SARAS airframe. A feasibility study was

undertaken to reduce the weight of bus bodies of KSRTC. It is estimated that a weight reduction to the tune of about 346 kg can be achieved. Other studies also included certain aspects of impact and crash of vehicles using MSC/DYTRAN. As part of the exercise towards the evolution of a civil aviation policy, four reports were brought out on the feeder aviation sector in the country and a website (www.viman.res.in) was launched.

Use of smart concepts in the control of structural behaviour and health monitoring are being attempted in aerospace applications. One such attempt is in the field of aeroelasticity to enhance the flutter margin substantially and to control the vibration levels in aircraft structures. A scheme has been evolved to control the dynamics of the wing type structure involving piezo-electric coupled analysis, actuators/sensors and the associated control laws. The dynamic model of the empennage of the T-tail configuration of SARAS is required to be tested in a wind tunnel to establish the aeroelastic characteristics and flutter clearance. A 1/10th model designed for this purpose is ready for tunnel testing.

A major facility augmentation programme of NTAF at NAL is in progress. As part of the programme, an additional air storage system has been designed. Modifications to fore body geometry of scaled naval/trainer versions of LCA Kaveri intake models have been carried out to suit the geometry of variants of LCA. The GFRP foam sandwich radome of SARAS has entered trial production.

The facilities at the RN Computer Centre of the Division were augmented with two powerful nonlinear FEA software: MSC/DYTRAN and ABAQUS (implicit and explicit), and a couple of work stations (IBM 6000/44P).

The Structures Division played a major role in the expansion of the NAL campus computer network. A management information system (MIS) to handle all the information of the Division online has been designed.