

To

C V Giri Raj, Secretary
Organising Committee, PLMSS-2008
KTMD, National Aerospace Laboratories
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- **Airframe Layout and Design**

Loads on airframe: Cockpit layout; Cabin layout; Load path considerations; Tail boom design; Empennage design; Design for maintainability; Design for Environment; Landing gear design.

- **Helicopter Crashworthiness**

Background to crashworthiness requirements; Crashworthy design requirements for civil, army and naval helicopters; Airframe design for crashworthiness; Crashworthy seats.

- **Selection of Materials**

Ashby material selection charts; Selection of materials from energy considerations; Material selection for rotor, transmission, and airframe; Estimation of vehicle life cycle energy from material manufacture to recycling.

- **Life Cycle Cost Estimation**

Purchase cost of helicopters; Total life cycle cost (development, production, operation, recycling); Direct operating cost; Indirect operating costs.

Who should attend? Helicopter designers and manufacturers, Helicopter operators, scientists and engineers from research institutions interested in design aspects of helicopter. Students and faculties from academic institutions

Registration: The registration fee is Rs. 5000/-, which includes a copy of the lecture notes, working lunch, tea/ copy on all days and a workshop kit. For students, the registration fee is Rs. 3000/-.

Intake: About 50 participants by registration only. Application in the format given in the brochure with registration fee must be sent on or before 10 October 2008 to: The Secretary, C V Giriraj, KTMD, National Aerospace Laboratories, PB 1779, Bangalore 560 017, India.

Venue: National Aerospace Laboratories, Kodihalli Campus, 43 km from new airport, 12km from city railway station and KSRTC bus stand. Accommodation for a limited number of participants is available at NAL Guest House on first-come first-serve basis.



**50 Years of
National Aerospace
Laboratories**

National Workshop on Helicopter Design for the Environment

12 - 14 November 2008



Chairman
Dr. V T Nagaraj

Venue
National Aerospace Laboratories
Bangalore, India

Organised by
National Aerospace Laboratories
(Council of Scientific and Industrial Research)
Bangalore, India

THE SPEAKER: Dr. V.T. Nagaraj, Senior Research Scientist, Alfred Gessow Rotorcraft Center, University of Maryland, College Park, MD

He has a Bachelors degree in Civil Engineering from the University of Mysore, a Masters degree in Aeronautics from Indian Institute of Science, Bangalore and a Ph.D. in Aeronautics from Loughborough University of Technology, England. He has worked at Hindustan Aeronautics Limited, Bangalore, India for over 35 years in the design of fixed wing and rotary wing aircraft. He has over 18 years of experience in helicopter design. He was actively associated with the design and development of Dhruv, the advanced light helicopter designed by Hindustan Aeronautics. He was responsible for the design and analysis of the composite rotor blades and the hingeless hub. He was chief of the ground testing group and was responsible for the development and certification tests of components of the helicopter. He has been a Senior Research Scientist at the Alfred Gessow Rotorcraft Center, University of Maryland from July 1997. Along with Professors Inderjit Chopra and Marat Tischenko, he has advised graduate students in Helicopter Design for over 10 years. From 1998, the Maryland teams have won the first place (8 years) and second place (2 years) in all the Student Design Competitions organized by the American Helicopter Society. Together with Professors Inderjit Chopra and Sung Nam Jung, he is active in the analysis of composite rotor blades. He has published over 30 papers in refereed journals and has over 50 conference publications covering the areas of composite analysis, helicopter and aircraft structural dynamics and design. He has co-advised three students for Ph.D. He is a Fellow of the Aeronautical Society of India. He is a member of the AIAA and the AHS. He serves as a member of the Technical committee on Aircraft Design of the AHS and is an Associate Editor of the AHS Journal.

OUTLINE OF LECTURES

• Objectives of Design for the Environment

Outline of a strategy for Design, Development, Manufacturing, Operation and Recycling for effective protection of the Environment while meeting the customer requirements at a competitive cost.

• Understanding Customer Requirements

Translating customer requirements to engineering requirements; Use of House of Quality, Pugh Matrix; Types of rotorcraft concepts.

• Generating Design Alternatives: Tishchenko's Method – I

Initial sizing of helicopter; Lift-to-drag ratio and propulsive efficiency; Energy Efficiency of helicopters and other vehicles.

• Generating Design Alternatives: Tishchenko's Method – II

Outline of Tishchenko's Methodology; Weight efficiency; Estimation of component weights – Rotor blade and Rotor Hub.

• Generating Design Alternatives: Tishchenko's Method – III

Estimation of component weights – Swashplate, Main gear box, Tail gear box, Intermediate gear box, Transmission shaft, Fuselage, Landing gear.

• Helicopter Performance

Hover performance; Climb performance; drag estimation; forward flight performance; W-A-T charts, Payload-Range curves.

• Main Rotor Configuration Design

Considerations in the selection of main and tail rotor geometric configuration (planform, disk loading, number of blades, aspect ratio, taper, twist, tip shape, solidity, root cutout, frequency placement, tip speed), airfoil selection

• Main Rotor Blade and Hub Component Design

Design features of rotor hubs (teetering, articulated, hingeless, bearingless, soft-in-plane, stiff-in-plane); Influence on handling qualities; Elastomeric bearings, drag dampers, design of composite rotor blades.

• Tail Rotor Design

Types of tail rotor, Selection of configuration (diameter, tip speed, disk loading, twist, direction of rotation, pusher or tractor), structural design aspects.

• Vibration Sources and Vibration Reduction

Helicopter vibration sources; Vibration levels, vibration reduction techniques, vibration isolation, vibration absorbers, passive and active vibration control.

• Acoustics Considerations

Sources of helicopter noise; Main rotor design for low noise; Flight path management for low noise.

REGISTRATION FORM

Name:

Qualification:

Organization/Institution:

Mailing address:

Phone:(off)
(Mobile)

Email:

Accommodation : Required / Not required

Signature of the Participant

Signature of the Head of the Institution

Mode of Payment: Payments should be made through crossed demand draft on any nationalised scheduled bank in favour of 'PLMSS-08'. Payable at Bangalore and sent to the Secretary of the Workshop.