

NWTF Faculty & Management

NWTF Faculty:

The faculty members associated with NWTF are:

- ✦ **K. Poddar**, Head
- ✦ **T.G. Pai**, visiting Professor
- ✦ **Brajesh Chandra**, Principal Research Engineer
- ✦ **Rajeev Gupta**, Principal Research Engineer
- ✦ **Chaturi Singh**, Senior Research Engineer

NWTF Management:

The National Wind Tunnel Facility is a Central Research Facility of IIT Kanpur with its own Head directly responsible to the Director of the Institute. The Head of the facility is assisted by a Technical Committee comprising of faculty members from various departments of the institute for proper functioning of NWTF. The members of the technical committee are:

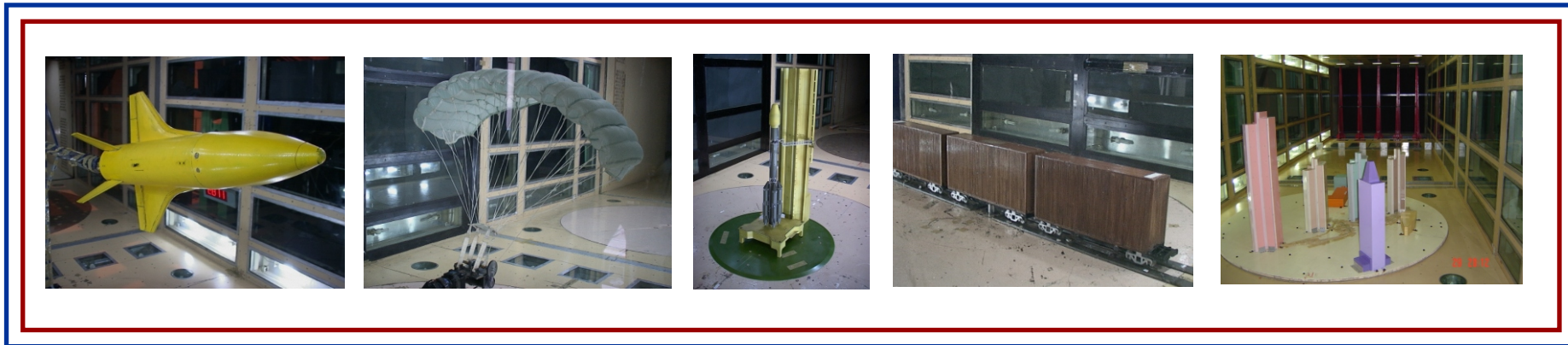
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|---------------------------------|------------------|
| ✦ Dean R&D , IITK | Chairman |
| ✦ Head , NWTF | Convener |
| ✦ Head , AE | Member |
| ✦ A.K. Mittal , IME | Member |
| ✦ Gautam Biswas , ME | Member |
| ✦ Rajesh Srivastava , CE | Member |
| ✦ Joseph John , EE | Member |
| ✦ Sanjay Gupta , ACMS | Member |
| ✦ Sudhir Kamle , AE | Member |
| ✦ Brajesh Chandra , NWTF | Member |
| ✦ Rajeev Gupta , NWTF | Member-Secretary |

Indian Institute of IITK Technology Kanpur

National Wind Tunnel Facility



The National Wind Tunnel Facility (NWTF), established in 1999 at IIT Kanpur to meet the national needs in areas of aeronautical and non-aeronautical R&D activities, houses the most versatile and efficient wind tunnel in India. It has various simulation and measurement systems, interchangeable test sections and is capable of testing at wind speed up to 80 m/sec. NWTF is committed to take up sponsored and consultancy projects as well as supporting the academic research at IIT Kanpur. Graduate and undergraduate students from Aerospace, Civil, and Mechanical Engineering departments are provided an opportunity to carry out their theses/project work at NWTF. Faculty members from various departments of the institute participate in the functioning of NWTF.



Contact
Head

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Areas of Research

- ✦ Wind Tunnel Instrumentation VI based
- ✦ Decelerator Aerodynamics
- ✦ Unsteady and High Angle of Attack Aerodynamics
- ✦ Take-off and Landing Characteristics of Aerospace Vehicles Including Ground Effect
- ✦ Development of High Lift Devices
- ✦ Transport Aircraft Studies Including Aerofoil Development
- ✦ Helicopter Aerodynamics
- ✦ Missile Aerodynamics
- ✦ Aerodynamics of Road Vehicles
- ✦ Wind Effect on Structures Including Interference Effect
- ✦ Aerodynamics of Wind Power Devices
- ✦ Air Pollutant Dispersion

National Wind Tunnel Facility (NWTF)

Unique in testing large-scale hardware in a continuous subsonic air stream, the National Wind Tunnel Facility is a significant asset to the aerospace community and Nation. Offering state-of-the-art instrumentation and simulation capabilities, the NWTF is a vital part of the Nation's aeronautics research plans. With the ever-increasing demand for wind tunnel testing of aerospace and non-aerospace hardware, the importance of NWTF is greater than ever. Built in 1999, the NWTF has unique and nationally recognized capabilities to evaluate aerodynamic performance of flight and road vehicles as well as wind effects on civil engineering structures.

The NWTF is a closed-return, continuous, atmospheric wind tunnel equipped with several auxiliary systems for different testing needs. The test section of NWTF is 2.25m high by 3m wide and 8.75m long and is split into two parts; an upstream (5.75m) and a downstream (3m) part. Both parts are built in duplicate, as independent mobile units, but equipped with different auxiliary systems allowing four possible combinations of the test sections. With these arrangements, experiment setup change time for different test series can be significantly reduced. Air speed upto 80 m/sec in the test section is produced by a single-stage 12-bladed axial-flow fan powered by a 1000 kW variable speed DC motor. Four fine mesh screens placed downstream of the honeycomb and upstream of a 9:1 contraction ensure a flow of exceptionally low turbulence.

Important Features of NWTF

High Reynolds Number simulation

- ✦ Reynolds Number 0 to $5 \times 10^6/m$
- ✦ Speed Range 0 to 80 m/sec

Very low turbulence

- ✦ $u'/U < 0.08\%$ and $v'/U < 0.15\%$

High Productivity

- ✦ Interchangeable mobile test sections for faster setup change
- ✦ Fully automated control and measurement systems



Model Mounted on Turn Table



Model Mounted on sting type support System

Special Capabilities of NWTF

- ✦ Full-model testing with sting support system
- ✦ Half-model testing with external balance
- ✦ Two-dimensional model testing using turntables
- ✦ Ground effect simulation with moving belt
- ✦ Gust and cross-wind simulation
- ✦ ABL simulation for non-aerospace applications
- ✦ Aero-acoustic testing

Special Equipments available

- ✦ Sting type model support system with five independent motions
- ✦ Turntables systems for aeronautical and non-aeronautical applications
- ✦ Moving Belt Ground Plane for ground effect simulation
- ✦ Laser light sheet generation system for flow visualization
- ✦ 3D Stereoscopic PIV system



Mobile Interchangeable Test Sections

Test Equipment and Data Acquisition

Model Attitude

- ✦ On model pitch, roll, and yaw sensors

Sting Support Motion Control

- ✦ Flex-motion eight-axis closed loop control
- ✦ Roll, Pitch, Yaw (0.01°) and
- ✦ Y & Z motions ($\sim 0.1mm$)
- ✦ Preset and continuous movements

Turntable Motion Control

- ✦ Siemens Servo-controlled drive
- ✦ Dual synchronized motion

Pressure Measurements

- ✦ PSI Scanners (11 nos., 32 ports each)
- ✦ 10", 20" & 70" WC with 0.05% Accuracy

Force Measurements

- ✦ Internal strain gage balances, load cells

Velocity Measurements

- ✦ DANTEC Streamline CTA system
- ✦ Hot-wire probes and calibrator

Data Acquisition System

- ✦ Industry Standard PXI system with real time embedded controller
- ✦ Network of Personal Computers
- ✦ Virtual Instrumentation (LabVIEW)
- ✦ Separation of console & user stations
- ✦ Standard DAQ, Motion Control Hardware

Temperature

- ✦ RTD, SS sensors, and thermocouples

Noise Measurements

- ✦ B & K Microphone Sensors and amplifier

3D PIV-System

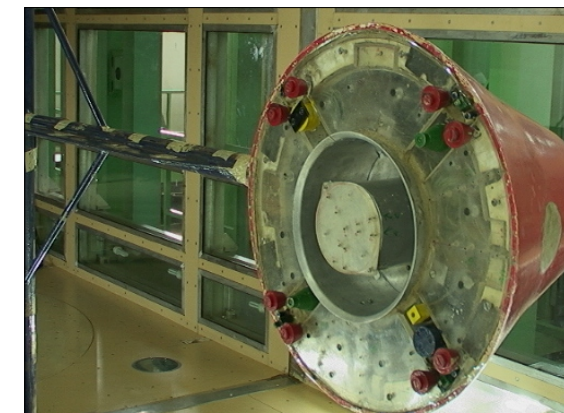
- ✦ Velocity field measurement
- ✦ 200 mJ, Dual Pulse Yag Laser
- ✦ Nikkon make 4MP PIV cameras
- ✦ High speed frame grabber

Flow Visualization System

- ✦ Light sheet generation using 6W Ar-Ion Laser Image monitoring and recording system

Recent R&D Activities at NWTF

- ✦ Laminar airfoil for Regional Transport Aircraft (RTA) program
- ✦ Low Reynolds number airfoil studies for MAV applications.
- ✦ Design and wind tunnel testing of 2D airfoil for UAV applications
- ✦ Wind tunnel studies on RLV ascend and descent configurations
- ✦ Ground wind studies of GSLV M3 configuration
- ✦ Low speed air-intake studies on fighter aircraft configurations
- ✦ LRSAM Rear fin deployment study in subsonic wind tunnel
- ✦ Low speed wind tunnel test on MK-III missile configuration
- ✦ Aero-elastic studies on chimney and cooling tower for various thermal power stations
- ✦ Wind Tunnel Study on rigid model of 81 storey residential tower
- ✦ Wind Tunnel studies on double staked wagon for railway



Aero space Applications



Civil Application