

Turbomachinery and Propulsion: Flow analysis in steam and gas turbines, axial and centrifugal compressors and pumps; numerical and experimental conjugate heat transfer in turbine blades cooling channels and in micro-gas turbines; multidisciplinary multipoint optimization of turbomachinery components; time-averaged and time-resolved aerothermal



Aero-thermal turbine performance

measurements in cascade and stage configurations for high pressure turbines (rotor/stator and stator/stator interactions), low pressure turbines (wake/boundary layer interactions and wall roughness) and compressors (boosters, casing treatment, flow control); cooled high-pressure turbine external and internal heat transfer, including tip flows.

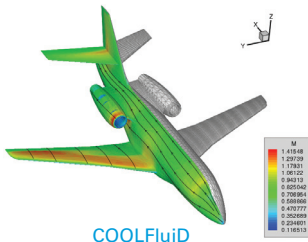
Applied Fluid Dynamics:

Aerodynamic aspects related to automobiles, high speed trains and sailing boats; fluid dynamics aspects of industrial processes; numerical simulation of industrial flows; liquid film instabilities; heat transfer in complex flow systems; biological flows.



Ground vehicle aerodynamics

Computational Fluid Dynamics: Development of numerical techniques for the solution of fluid flow equations; high resolution schemes on unstructured grids, finite element and finite volume methods, hybrid grid generation, error estimation and solution adaptive remeshing.

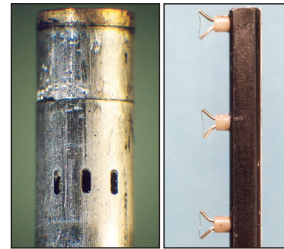


COOLFluid

Applications to compressible flow, ideal MHD, high-temperature reacting flows, two-phase flow equations, electro-chemically reacting flows.

Measurement Techniques:

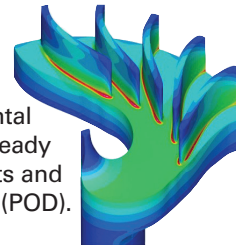
New facilities and measurement equipments, data acquisition systems, hot wire and laser anemometry, image processing, particle image velocimetry (PIV) and particle tracking, micro PIV, rainbow thermometry, optical diagnostics of bubbles, droplets and films, infrared thermography, pressure sensitive paints, liquid crystals, diode laser absorption, time-resolved emission, laser-induced fluorescence, high temperature cooled fast response total pressure probes, fast response temperature probes, skin friction and heat flux measurement techniques for high speed flows.



Fast response aerodynamic and temperature probes

Data Post-Processing:

Development of post-processing tools for numerical and experimental data: time history signals, 2D unsteady signals from PIV and CFD; wavelets and proper-orthogonal decomposition (POD).



Rotor stress distribution

VON KARMAN INSTITUTE FOR FLUID DYNAMICS

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RESEARCH AND CONSULTING



VON KARMAN INSTITUTE FOR FLUID DYNAMICS



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THE VON KARMAN INSTITUTE FOR FLUID DYNAMICS undertakes and promotes research in the field of fluid dynamics. It possesses about fifty different wind tunnels, turbomachinery and other specialized test facilities, some of which are unique or the largest in the world. Extensive research on experimental, computational and theoretical aspects of liquid and gas flows is carried out at the VKI under the direction of the faculty and research engineers, sponsored mainly by governmental and international agencies as well as industries.

VKI EXPERTISE

Advanced wind tunnel testing

CFD, high performance computing

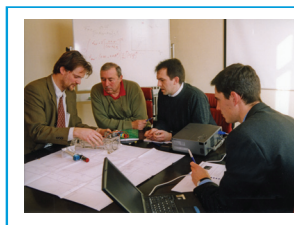
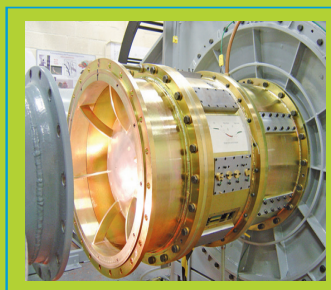
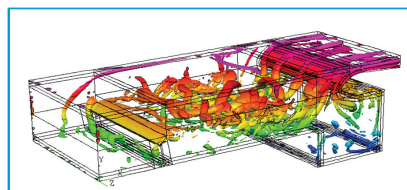
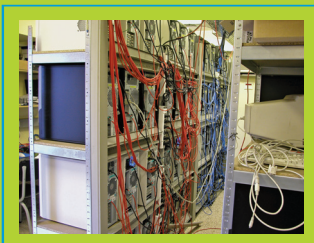
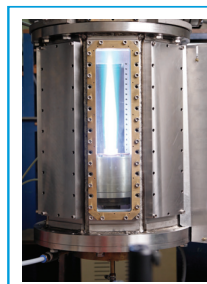
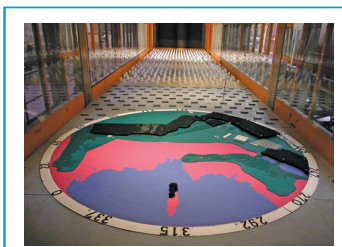
Theoretical modeling

Industrial validation

Long term international contacts

Design of dedicated test bench

Consulting



RESEARCH ACTIVITIES

Aeronautics/Aerospace:

Aerodynamic aspects of subsonic, transonic, and supersonic flight; atmospheric reentry flows, including aerothermodynamics, laminar-turbulent transition, shock-boundary layer interactions; stability of re-entry vehicles at subsonic, transonic, supersonic and hypersonic speeds.



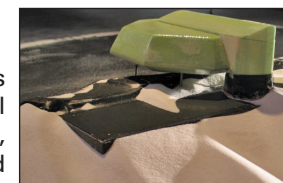
Hypersonic flow

Plasma Flows:

Determination of transport properties for high temperature reacting plasma flows; plasma characterization using spectroscopic measurements; space re-entry thermal protection materials testing and catalytic determination; instrumentation developments; planetary atmosphere collisional-radiation dynamics.

Wind Engineering:

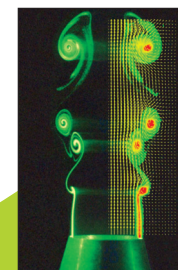
Wind effects on buildings and structures, local effects of wind, snow drift, pollutant dispersal and microclimate.



Belgian Polar Station in atmospheric Wind Tunnel

Aeroacoustics:

Noise from subsonic jets and from vortex-body interaction; numerical prediction of aerodynamic noise; aeroacoustics in solid rocket motors; thermo-acoustic instabilities.



Aeroacoustics

Turbulent and Two-Phase Flows:

Simulation of turbulent shear layers: DNS and LES; flows in cavities and over steps; mitigation of major industrial hazards by liquid curtains; dynamics of flashing two-phase flows; bubble dynamics.

Member or associate of the AIAA, ASME, ERCOFTAC, EREA, Euroavia, EWA, GTSJ, IAF, ICAS, RTO, STAI.
Secretariat of EVI-GTI and ETC / Participation in EU and ESA programmes.