

The Center for Fluid Mechanics and Energetics (CMEFE) at *hepia*, Geneva, receives 1 MCHF to boost its activities.

The Center for Fluid Mechanics and Energetics (*CMEFE*, to be pronounced “kmayfay”) at the *haute école du paysage, d’ingénierie, et d’architecture (hepia)* in Geneva is now more than 100 years old, and is getting a new look.

Thanks to the support of the *Geneva State*, more than 1 MCHF have been invested in the last few months to renew the laboratory infrastructure, experimental equipment, and computational capabilities.

hepia is part of the *HES-SO* (University of Applied Sciences of Western Switzerland) and pursues activities in the fields of education and research in engineering, architecture and landscaping. As compared to Swiss Universities and Polytechnical Schools (*EPFL*, *ETHZ*), research pursued at *hepia* focuses on applied aspects more than on fundamental ones. In this framework *hepia* develops experimental facilities through different strategic axes. One of them is fluid mechanics with a laboratory composed of three professors (Prof. Patrick Haas, Prof. Roberto Putzu, and Prof. Flavio Noca), one technical staff and several research assistants (see www.cmeffe.ch for more details).

The laboratory currently houses aerodynamic and hydrodynamic facilities, as well as a computational infrastructure. The hydrodynamic facilities are located on the main site of the school and boast a hydrodynamic tunnel and a set of hydraulic machines. The aerodynamic facilities are located in an unusual location - underneath one of the main bridges in Geneva (the “Pont Butin”) where originally a tunnel trench was dug in order to fit train tracks. The underground tunnel was never completed; it was later used by Hispano-Suiza for weapons testing, and is now home of the largest wind tunnel in the French-speaking part of Switzerland, with windspeeds up to 250 km/h.

The tunnel is the official testing platform for the French Ski Federation. It provides an ideal training site for Olympic athletes (mainly for position and movement optimization in downhill as well as long jump competitions), but also a good opportunity for testing novel equipment. In addition to skiing, the tunnel has also an official agreement with Mavic, a world leader in the cycling equipment industry; in particular, the collaboration aims at improving the aerodynamic elements of its products (wheels, helmets, etc.). The tunnel also hosts a Mavic partner, the Altair bicycle from the IUT of Annecy, the university world record holder for speed (118 km/h).



The tunnel also offers testing time to individual parties (speed skiers in particular) for performance or equipment testing (one customer is Yves Rossy, “Jetman”, who has recently crossed the English channel with wings strapped on his back).

In the last year, *CMEFE* has become an official technical partner of the Formula One Teams Association (*FOTA*) and is in charge of team audits regarding aerodynamics test procedures.

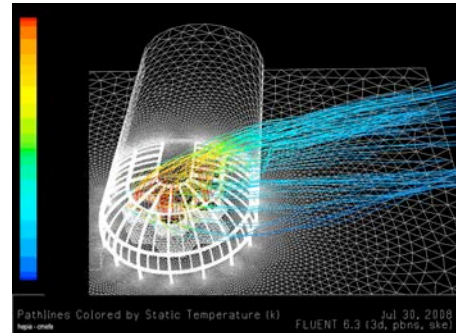
In addition to sports activities, *CMEFE* is widely involved with industry in various areas that involve aerodynamics and hydrodynamics. The research and development domains include train aerodynamics (roof components and air collectors with Sécheron, Bombardier etc.), environmental fluid mechanics (rivers), building (outdoor as well as indoor) aerodynamics, solar panels, wind turbines, and many other unusual fluid phenomena encountered with coffee capsules (Nespresso), toothpaste, industrial machines (electro-erosion with AgieCharmilles), thermal cooling of electronic components ecc. Another field of research focuses on space technology, in particular sloshing phenomena in launch vehicle fuel tanks as well microgravity fuel feeding technology (in collaboration with Thalès Alenia Space).

CMEFE also focuses on the development of novel measurement instruments in aerodynamics and hydrodynamics, in particular force balances and visualization techniques, and expects to maintain fruitful collaborations in this effort with ONERA-Modane (French Aerospace Laboratory), RUAG-Aerodynamics, DLR (German Aerospace Laboratory), and INSEAN (Italian Naval Laboratory).

In order to complement the experimental data, *CMEFE* provides customers with a wide array of computational fluid dynamics (*CFD*) tools, include flow analyses with commercial codes (Fluent) as well as

open source software (Open Foam). The computational resources include a few graphics stations HP Z800 (12 cores, 96 Gb RAM) as well as a host of SUN servers.

In addition, a new calculation cluster of 224 cores has been installed at *hepia*. As a partner of the Multi site ARC project, *hepia* in collaboration with SUPSI from Lugano (Switzerland) is working at the delivery and installation of a high power computing distributed network for Switzerland. The new cluster named «Gordias» (ClusterVision, 14 twin boards, double CPU quad cores for a total of 224 cores, connexion « infiniband », CPUs « Intel Xeon E5530 » at 2.40 GHz) has been connected to SMSG (Swiss Multi Science Grid).



In the last few years, a decision was taken that a global refurbishment of the laboratory was needed to maintain a competitive edge with the current needs of academic researchers as well as industry.

In that regards, *hepia* has engaged into fruitful discussions with *EPFL* to transfer some of its facilities to Geneva. In particular, *EPFL* had expressed a need to relocate its “S-shaped” wind tunnel. *hepia* has thus offered to be the new home to the “S-shaped” wind tunnel. The tunnel was designed and built by a number of people, among which late *EPFL* Professor Inge Rhyning as well as Dr. Trong-Vien Truong (presently manager of experimental fluid mechanical facilities at *EPFL*). The tunnel was later placed under the supervision of Professor Peter Monkewitz, and is now part of Professor François Gallaire laboratory. It was built in the 80s in the context of a european turbulence research consortium (ERCOFTAC). With the new redirection of activities at *EPFL*, Prof. François Gallaire (the head of the Laboratory of Fluid Mechanics and Instabilities) has accepted to move the facility to Geneva in exchange for continuing collaboration between *EPFL* and *hepia*.

While the details have not been finalized, it is expected that the tunnel will be slightly modified into a straight section tunnel (instead of S-shaped) with a larger test section (1 m x 1 m). The tunnel will thus be characterized by a long test bay (9 m) with a low turbulence level and intermediate velocities (20 m/s), adequate for environmental, sensor, industrial, or fundamental turbulence research or testing.

The closed-circuit configuration of the tunnel will also allow the use of seeding particles and visualizations paints, thus enabling the implementation of modern quantitative visualization techniques such as PIV (Particle Image Velocimetry), LDA (Laser Doppler Anemometry), and PSP (Pressure Sensitive Paint). In addition, the low-turbulence quality of the (low-speed, 20 m/s) flow will complement the existing higher-speed (250 km/h) and larger (2m x 1.5 m section) wind tunnel of *hepia*.



Our present goal at *hepia* is to maintain this tunnel in activity, and, as in the past, nurture collaborations with *EPFL* faculty and students (Bachelor, Master, and PhD), through the use of this wind tunnel as well as the other numerous fluid mechanical and computational facilities already present at *CMEFE*.

The facilities will be even more attractive, as *hepia* has decided to invest substantially into the renovation of the instrument pool. *hepia* will soon be able to provide users with state of art fluid mechanics instruments such as a wide array of force balances (RUAG-Aerodynamics), pressure sensor arrays (PSI) and manometers (Furness Controls), data acquisition systems (HBM), as well as flow measurement instruments including Pitot tubes (Schiltknecht Messtechnik, Aeroprobe), multi-component LDA, 3D PIV, and high-speed flow visualization, in water as well as in air. The site will thus be beneficial not only to industry, but also to prospective Bachelor, Master, and PhD students, as well as postdoctoral fellows and faculty members from surrounding institutions, including *EPFL*, the University of Geneva, and the various *HES-SO* schools, and other worldwide academic centers (such as our current collaborators, among which Caltech, Politecnico di Torino, University of Hannover etc.).