EPFL-Alinghi Collaboration

Technology Makes the Difference

The America's Cup cannot be won with last year's technology. From the initial design of the boat up through performance analysis in race conditions, many technological details must advance rapidly for a team to win the trophy. The ultimate test of four years of hard work paid off July 3, 2007, in Valencia when Alinghi scored a one-second victory over Team New Zealand in a nail-biting race full of passion, drama, and changing winds, bringing the 2007 America's Cup to Switzerland once again.

History of the collaboration

EPFL collaborated with Alinghi in the period leading up to the 2003 America's Cup victory, and this collaboration generated a strong relationship between the Alinghi Design Team and EPFL researchers. The number of research topics was increased for the 2007 campaign, leading to a massive effort in terms of scientific research and strategic implementation of new technologies. Currently, more than 50 scientists from seven EPFL laboratories are directly involved in research or testing projects.

The role of EPFL as scientific advisor

The Scientific Advisor acts as an extension of Alinghi Design Team. Research is carried out in close collaboration with the Alinghi designers. Scientific and technological advances developed in the university are quickly adapted to and implemented in the very specific domain of an America's Cup boat.

alinghi

EPFL
ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

OFFICIAL SCIENTIFIC ADVISOR
ALINGHI DEFENDER 32nd AMERICA'S CUP

A Brief Summary of Research Topics

Materials development

The hull of Alinghi is made of a rigid, strong and incredibly light carbon-reinforced polymer composite material referred to as a "sandwich". The production process for this composite sandwich involves several steps, and a variety of factors must be optimized for reliability and performance.

Fiber-optic sensors

A recent technological advance involves embedding optical fibers in the sandwich structure, making these composites "intelligent" as they provide real-time feedback on how the boat is performing.

Testing

Full scale testing of large elements of the structure is carried out in the laboratory and in hydraulic tanks to define the fatigue resistance and maintenance plan of sensitive elements. In parallel, new non-destructive testing techniques are developed in collaboration with the School of Business and Engineering Vaud (HEIG-VD) that allow us to assess the "health" of the composite sandwich over time.

Fluid Dynamics Analysis

Computational Fluid and Structural Dynamics (CFSD) is a mathematical approach that aims at simulating a wide range of flow conditions. Numerical models are used to simulate the flow – of both the air and the water -- around a computerized version of the yacht in racing conditions. These models lead to improvements in design of elements such as the keel, the rudder and the hull.

Video analysis for sail design

One way to improve the design of sails is to analyze how they behave under actual sailing conditions and to extract data on how the sail, and ultimately the boat, is responding to physical conditions. One solution currently developed at EPFL to evaluate these performances is to extract the information from video sequences.

Strategic Route Planning

Another project aims to help the navigator by making sailing as much a science as possible. Researchers are developing a mathematical model that will be able to provide the navigator with a rational method for planning out the fastest possible course for a given race, even in the face of variable weather conditions.

The work of EPFL is sponsored by CTI, the Swiss Innovation Promotion Agency

EPFL-Alinghi Q & A

How do EPFL Students participate in the collaboration?

Many of the research projects actively involve students. The close collaboration with the Alinghi Designer as well as the unique high profile dynamic of an America's Cup challenge is an exciting and motivating environment. Often, deadlines are tight and results must be produced quickly. Masters students willing to undertake the challenge can make their Alinghi-related work the subject of their master's thesis project. Bachelor's and Master's students also participate in specific semester-long projects. Several recent diploma project reports are posted on the site http://alinghi.epfl.ch/page10237-en.html. This year, the eight best student projects received an all-expenses paid trip to Valencia to see the America's Cup in person.

What's unique about this kind of research?

The collaboration gives EPFL a unique chance to see cutting edge research immediately applied. It is also an opportunity for researchers from different fields to work together towards a common goal, sharing knowledge at the interface of their specific research domains. This rapid pace jump-starts new developments and synergies, and is the most efficient way to make technology advance.

The sports industry plays an important role in bringing new technologies to the marketplace. In other sectors, such as the aerospace and automotive industries, huge amounts of testing and validation must be carried out prior to implementation. In contrast, market changes in sports equipment are very rapid, imposing stringent time constraints but allowing technology to advance more rapidly.

What's in it for EPFL? For Switzerland?

Alinghi is without doubt a showcase for Swiss research. The success of Alinghi has made it possible for EPFL to demonstrate and communicate worldwide the cutting edge research performed in its laboratories. The collaboration has attracted many students and researchers to campus and generated new contacts in academia and industry.

EPFL's researchers are working in close collaboration with the Design Team of Alinghi and with Swiss companies that produce the different elements of the boat. In our close collaboration with the Décision boatyard, for example, researchers and students have had daily contacts with the boat builder, exchanging information and results.

The success of the Alinghi collaboration makes it easier to demonstrate the potential of this kind of applied research to other Swiss industries in the field. We can spark their interest in joint developments to apply these kinds of technologies in their specific contexts.

Student Comments

Samuel Vionnet, Master's student in Materials Science

Has Alinghi been a motivating factor for your studies?

I'm a student in materials science. I chose this subject because I wanted to work in the world of sailing or sports. There are lots of applications of materials science in sailing – it's an interdisciplinary sport, one that has concrete applications.

How does the Alinghi collaboration fit into your studies?

From the beginning I planned to do a project on Alinghi. I had to wait until I was in the Master's cycle to do this, because it's a project that takes up more than 10 hours a week. Because it's my passion, I had to do at least one project. Other than that, the second semester of my Masters program, I'm continuing on a project involving the sails. I'm going to try to link up my diploma work with this project, in the hopes of afterwards finding a job in this area.

Any comments?

I got involved in the Alinghi project more because it concerns sailing (and composites) than for any other reason. My current project on the sails is the most interesting. To be able to combine my studies with my passion is a real advantage (for motivation, among other things!) And I hope to be able to eventually combine my work with my passion as well.

More Information

http://alinghi.epfl.ch
http://www.alinghi.com