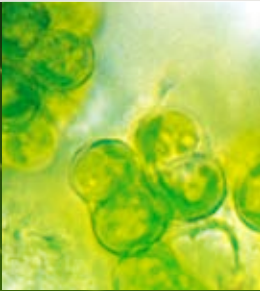




CORPORATE TECHNICAL OFFICE



# FIRST FLIGHTS WORLDWIDE WITH PURE BIOFUEL FROM ALGAE

An **eCO<sub>2</sub>avia** by EADS INNOVATION WORKS Project





## A WORLD PREMIERE: THE FIRST FLIGHTS OF AN AIRCRAFT WITH PURE ALGAE BIOFUEL

At the ILA 2010 in Berlin, the EADS biofuel project is showcasing the world's first flights of an aircraft powered by pure biofuel made from algae. A Diamond Aircraft DA42 New Generation powered by two Austro Engine AE300 engines takes part in the daily airshow flight demonstrations, following engine test stand runs and test flights at Diamond's home base in Wiener Neustadt, Austria.

The tests proved that only relatively minor modifications and adjustments had to be made to the aircraft's engines to qualify the biofuel from algae for the demonstration flights. Due to the higher energy content of the algae biofuel, the fuel consumption of the Diamond DA42 New Generation is 1.5 litres per hour lower when compared to conventional JET-A1 fuel – while maintaining equal performance. Running on biofuel made from algae, the amount of carbon

dioxide released during flight is about equivalent to the amount absorbed by the algae during their growth phase. This opens up the possibility of carbon-neutral flights. In addition, nitrogen oxide and sulfur oxide emissions will also be reduced (up to 40 percent less nitrogen oxides and ca. 10 ppm sulfur oxides vs. 600 ppm of conventional Jet-A1-fuel) due to the very low nitrogen and sulfur content of the biofuel compared to fossil fuel.

## MICROALGAE – TREMENDOUS POTENTIAL TO BE TOMORROW'S AVIATION FUEL

Algae are considered to be promising potential feedstock for biofuels, as certain species of algae contain high amounts of oil. This oil can be extracted, processed and refined for various uses. Grown for many years on a commercial basis for the development of products such as food supplements and cosmetics, microalgae have now emerged as one of the leading sources for alternative fuels.

// Microalgae are microscopic organisms that use sunlight, water and minerals to grow by photosynthesis, while absorbing the greenhouse gas carbon dioxide to grow by photosynthesis.

// Microalgae reproduce rapidly and create at least 30 times more organic substance (biomass) per cultivation area than, for example, rapeseed. Their cultivation does not compete with food production. Algae can be grown on poor quality land using non-potable or saltwater.

// Biofuel from algae has a significantly lower content of Nitrogen and Sulfur compared to fossil fuels. Consequently, nitrogen oxide and sulfur oxide emissions from combustion will be reduced significantly.

**EADS Innovation Works and Diamond Aircraft have partnered for this premiere: the flights of a Diamond DA42 New Generation aircraft**

As a systems architect of aircraft and helicopters, EADS considers it to be its responsibility to foster research on biofuels, even if it is not directly involved in the energy business. Therefore, EADS pursues research for suitable alternatives to fossil fuels and works together with leading research institutes as well as state governments and stakeholder companies from around the world towards achieving the climate protection goals of the aviation industry. The goals for the year 2020 set by the Advisory Council for Aeronautics Research in Europe (ACARE) include a carbon dioxide reduction by 50% and a nitrogen oxides reduction by 80%.

EADS considers algae to be a promising source of sustainable biofuel, because biofuels from algae offer the long-term potential of sufficient life-cycle carbon-

dioxide reductions to replace crude oil-based fuel. Algae can be produced in sufficiently large quantities without competing with food production for fertile land or potable water. EADS research shows that all necessary technologies to develop the production of biofuel from algae are known, but industrial size and economy require further development. EADS is working with partners towards a pilot project to develop the necessary industrial infrastructure. The project is led by EADS Innovation Works, the corporate research and technology network of EADS and supported by the Bavarian Ministry of Economics, Transportation and Technology through the Government of Upper Bavaria with funding from the Bavarian aerospace research and technology programme (Project Bay68 "Biofuel from Algae").

The project is carried out in partnership with IGV GmbH of Potsdam, Diamond Aircraft and Austro Engines of Austria. The algae oil for flight testing and demonstration flights was delivered by Biocombustibles del Chubut S.A. in Argentina and refined into biofuel by VTS Verfahrenstechnik Schwedt, Germany.

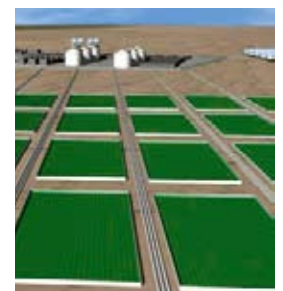
This is one of the projects that are grouped under the name of **eCO<sub>2</sub>avia** by EADS INNOVATION WORKS.



## THE CULTIVATION OF MICROALGAE

Series-production photobioreactors from IGV GmbH are used to reproduce and grow microalgae. In the future, the same technology can be used to build larger facilities for the large scale production of algae biomass for biofuel. Biocombustibles del Chubut S.A. in Argentina is working with a combination of photobioreactors and ponds with a transparent roof, a promising solution for good algae yields where climatic conditions permit such installations.

Cost is an important factor – currently it is significantly more expensive to produce oil from algae in comparison to sourcing crude oil. If algae-based fuel is to be able to compete with kerosene, research and development work must aim to establish a cost-effective mass production of algae biofuels using industrial quantities of carbon dioxide.



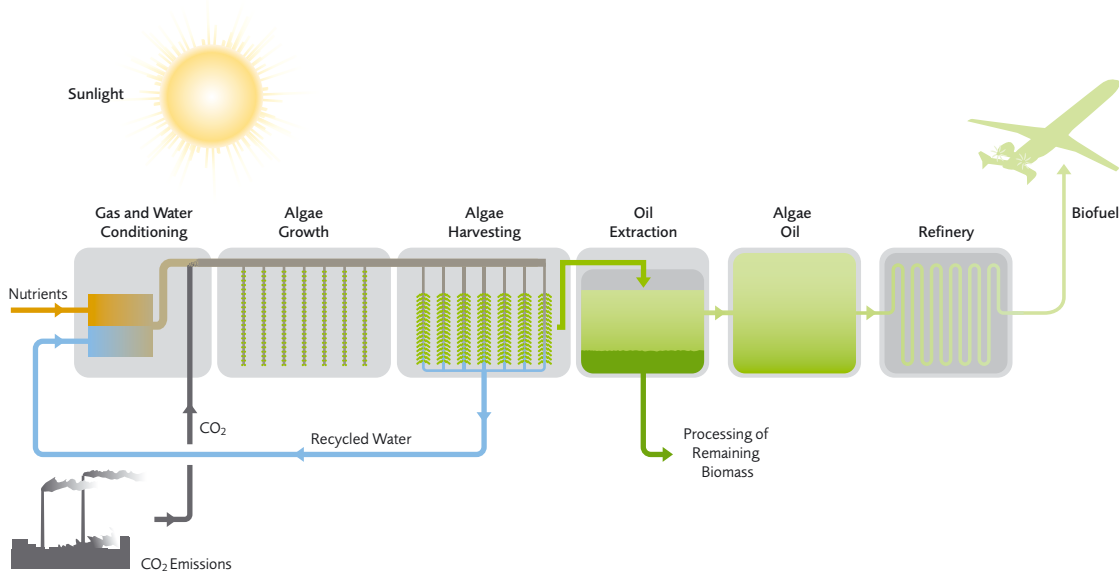
Microalgae as seen under a microscope.

## THE PROCESS: FROM ALGAE TO BIOFUEL

To cultivate algae, carbon dioxide, water and minerals such as calcium and iron are required. The most essential ingredient, however, is sunlight, which provides the algae with the energy necessary to reproduce and grow.

Algae can be harvested daily. Filters and a centrifuge are used to remove 90% of the water, which is mostly

recycled. The oil contained in the algae is extracted by mechanical or chemical processes from the biomass and refined into biofuel. Each 100 kg of algae biomass grown absorbs 180 kg of CO<sub>2</sub>. From this 100 kg, extraction yields 22 litres of algae oil, which can then be refined to 21 litres of biofuel. The 80 kg of remaining algae biomass can be used for other purposes such as animal feed, fertilizer or energy/heat.



### For more information:

E-Mail: [innovationworks@eads.net](mailto:innovationworks@eads.net)  
[www.eads.com](http://www.eads.com)