

**PRESS RELEASE**

**Turbines and fans inspired by whales:
Stephen Dewar, Philip Watts and Frank Fish named European Inventor Award 2018 finalists**

* **US biologist Frank Fish, US/Canadian aeronautical engineer Philip Watts and Canadian filmmaker, inventor and entrepreneur Stephen Dewar nominated for European Patent Office (EPO) prize for developing more powerful, energy-efficient and quieter rotating blade design for wind turbines and fans**
* **Biomimetic turbine design based on the flippers of humpback whales can help wind farms produce up to 20% more power with less wind**
* **EPO President Battistelli: "Dewar, Watts and Fish's invention has the potential to make an impact on both worldwide energy consumption and production, particularly as we increasingly rely on green technology."**

**Munich, 24 April 2018 –** Rotating blades are at work in numerous applications from electricity-generating wind turbines to industrial blowers and the small cooling fans in computers and other electronics. Although the uses for these blades continue to rise, the aerodynamic science behind them has changed little since the 1930s and it was long assumed that the blades' leading edge should be straight and smooth. US biologist Frank Fish, US/Canadian aeronautical engineer Philip Watts and Canadian entrepreneur Stephen W. Dewar, however, are challenging and changing this notion. By looking to the flippers of humpback whales for inspiration, this team has developed turbine blades with three-dimensional bumps on their leading edges that alter the flow of air for greatly improved aerodynamic performance and quieter operation.

For this achievement, Stephen W. Dewar, Philip Watts and Frank Fish have been nominated as finalists for the European Inventor Award 2018 in the category "Non-EPO countries". The winners of this year's edition of the EPO's annual innovation prize will be announced at a ceremony in Paris, Saint-Germain-en-Laye, on 7 June 2018.

"Dewar, Watts and Fish's invention has the potential to make an impact on both worldwide energy consumption and production, particularly as we increasingly rely on green technology," said EPO President Benoît Battistelli announcing the European Inventor Award 2018 finalists. "Their work shows how nature can serve as a source of inspiration for refreshing and unconventional technological advances."

**Inspired by nature**

Interested in the relationship between biology and technology, the team of Dewar, Watts and Fish have borrowed from the "bumpy" flippers of humpback whales to develop their turbine blades. These whales display considerable efficiency and manoeuvrability for their roughly 30 000-kilogramm weight, as they migrate up to 25 000 kilometres each year and achieve short speed bursts of around 24 km/h. It was precisely this efficiency that fascinated biologist Frank Fish. He surmised that the rugged shape of a humpback whale's flippers – lined with irregular bumps known as tubercles that give them an unmistakeable saw-like profile – might add an extra efficiency boost. Unlike other whales, explains Fish, "The humpback whale actively manoeuvres to capture prey and the tubercles along with their long fins are important. Tubercles passively modify the flow over their wing-like flippers to give them greater lift and reduced drag."

After a few initial calculations, Fish wrote a research paper confirming his findings that captured the attention of aeronautical engineer Philip Watts. The two teamed up to more closely investigate the phenomenon and see if it might have practical applications. They showed that tubercles help to reduce water resistance at the tips of a whale's flippers. A typical aerofoil, they discovered, is actually fighting against some of the turbulent airflow it creates at its own tip. This results in vortices (whirling masses of air) that reduce efficiency as well as create extra noise. The humpbacked whale provides an elegant solution to minimise this turbulence. This phenomenon worked in water, as was the case for the whale, and the inventors postulated that this could also hold true in air if it was possible to develop a similar design for turbine and propeller blades.

"Right away from our initial [test] results we saw some impressive data," says Watts. "Once we had these results it was about going out into the real world and developing solutions. We were very surprised when these real-world applications lived up to and exceeded our expectations. It turned into an invention that keeps on giving."

Moving from the conceptual phase into prototype designs, Fish and Watts determined that by incorporating tubercle-inspired bumps, which they rounded and streamlined for maximum aero dynamic and fluid dynamic effects, they could increase the maximum lift of a wing while softening stall over what is termed *the angle of attack* by up to 40%. The result was an efficiency gain of roughly 20% if a tubercle-fitted blade was used in a wind turbine.

**A "virtual" intellectual property company**

To realise the potential of the tubercle concept, Fish and Watts were joined by Canadian filmmaker, inventor and entrepreneur Stephen W. Dewar to set up a company to develop, patent and market their new type of blade design. The three launched Canadian start-up WhalePower in 2005. With Frank Fish as President, Watts as Vice President of R&D, and Dewar as Vice-President of Operations, the firm began work as a "virtual" intellectual property company, licensing their designs to other companies that wanted to use the technology in their particular areas of expertise.

Dewar realised that there was only one US patent, filed by Fish and Watts protecting the important intellectual property behind the tubercle technology, and that patent protection in major regions outside of the US was needed. He also felt the US patent and other subsequent patents needed to be more specific in clearly describing the particular applications for which the technology could be used. He first focused on wind turbines and then looked to other areas that could benefit from the improved aerodynamics and efficiency that the technology can provide. Protected by a European patent and other patents throughout the world, WhalePower then expanded its blade designs from its first concepts for wind turbines to solutions for industrial blower and computer fan applications.

The company introduced the first Tubercle Blade HVLS (high-volume low-speed) fan to the market through a Canadian licensee and this industrial-scale fan is available in a range of diameters in 38 countries. These quiet fans offer 20 000 hours of maintenance-free operation while consuming as little energy as an average hair dryer, and they circulate about 25% more air than similar non-tubercle fans. A second Chinese HVLS fan manufacturer also sells HVLS fans with tubercles throughout China.

WhalePower has gone on to develop prototype fans for computer graphics cards, which a major manufacturer tested and found to be about 20% more efficient than the current market leader – a strong argument for the IT industry given that fans and cooling consume about 10% of the total power in applications such as servers. Use of the technology was also licensed to a German green energy producer who commissioned the German Aerospace Centre (DLR) to study the effects of model turbine blades equipped with tubercles in a wind tunnel. In addition to an efficiency boost of around 20%, the study found that noise was reduced by at least 2 decibels, fatigue loads by 6%-8%, and the lifetime of key components extended by 25% – the equivalent of three to six more years of use given the average 12 to 25-year lifetime of a wind turbine.

In the wind turbine market, for which WhalePower's concept was initially developed, global sales are forecast to grow from EUR 64.59 billion in 2015 to EUR 66 billion in 2019. The global market for industrial and commercial fans and blowers, where WhalePower has its first licensed product, is predicted to be worth some EUR 8.5 billion by 2022.

**Biologist, engineer and entrepreneur: a multidisciplinary team**

Born in New York City, Frank Fish has a PhD in zoology and has worked as a university professor, research scientist, and inventor for more than 40 years. He has published over 147 research articles, government reports, and book chapters. His research is focused on the energetics and hydrodynamics of aquatic locomotion by vertebrates with biomimetic applications. His work on the biomechanics of aquatic mammal propulsion has been funded by the US Defense Advanced Research Projects Agency (DARPA), National Science Foundation, and the Office of Naval Research.

Having earned his PhD in environmental engineering sciences from the California Institute of Technology in 1997, Philip Watts has developed and patented advances in the field of wind turbine technology while serving as an executive at several wind power companies. In addition to consulting for the insurance, oil and gas, and nuclear industries on tsunami modelling and hazard assessment, he has created open source modelling software that is distributed to tsunami scientists around the world. Watts has also published scientific papers on the aerodynamics of bat flight as well astronaut locomotion in space stations. He has authored more than 70 scientific publications and reports during more than 14 years of research.

As a prolific inventor and entrepreneur, Stephen Dewar's wide interests include scientific publications and science journalism. He was listening to CBC radio's *Quirks and* *Quarks*, which led him to track down Fish and Watts to inquire about their research – and ultimately became a partner in their company. He has spent 30 years writing, directing and producing hundreds of radio and television documentaries as well as dramas and comedies for the Canadian Broadcasting Corporation, the National Film Board of Canada, CTV, and CBS.

**Additional resources**

[**Video and photo material**](http://www.epo.org/news-issues/press/european-inventor-award/2018/dewar.html)

[**Read more about the inventor**](http://www.epo.org/learning-events/european-inventor/finalists/2018/dewar.html)

**Download our app "**[**Innovation TV**](https://www.youtube.com/watch?v=rYT_BqgAVIQ)**"** to your smart TV and watch video portraits of all finalists on your TV screen

 **View the patent:** [**EP1805412**](https://worldwide.espacenet.com/publicationDetails/biblio?DB=EPODOC&II=0&ND=3&adjacent=true&locale=en_EP&FT=D&date=20070711&CC=EP&NR=1805412A1&KC=A1)

**Nature as inspiration**

As WhalePower put it, they are building the energy future based on millions of years of evolutionary field testing. Other notable figures from the European Inventor Award that have been inspired by nature are the UK’s Fiona Fairhurst, who designed the [Olympics-grade bathing suit](https://www.epo.org/learning-events/european-inventor/finalists/2009/fairhurst.html) based on shark skin (2009 finalist in “Industry), Denmark’s Peter Holme Jensen, Claus Hélix-Nielsen and Danielle Keller who developed energy-efficient [water purification based on aquaporins](http://www.epo.org/learning-events/european-inventor/finalists/2014/jensen.html) (2014 winners in “SMEs), the Czech Republic’s Miroslav Sedláček, who invented the [rolling fluid turbine](http://www.epo.org/learning-events/european-inventor/finalists/2016/sedlacek.html) (2016 finalist in “Research”), and Morocco’s Adnane Remmal, who created [antibiotics boosted with essential oils](http://www.epo.org/learning-events/european-inventor/finalists/2017/remmal.html) (2017 winner of the Popular Prize).

[**About the European Inventor Award**](http://www.epo.org/learning-events/european-inventor.html)

[**About the European Patent Office (EPO)**](http://www.epo.org/news-issues/press/background/epo.html)

**Contacts at the European Patent Office in Munich, Germany:**

Jana Mittermaier

Director External Communication

Rainer Osterwalder

Press Spokesperson

Tel. +49 (0)89 2399 1820

Mobile: +49 (0)163 8399527

press@epo.org