



Fastest across the Atlantic

The release of Atlantic rower Kevin Biggar's book late in 2008 made public the link between mathematical optimisation and his and rowing partner Jamie Fitzgerald's world-beating record in the 2003 Trans-Atlantic Rowing Race. Jenny Rankine explains.

In *The Oarsome Adventures of a Fat Boy Rower (How I went from couch potato to Atlantic rowing race winner)*, Biggar describes how his need to find out the fastest route between the Canary Islands and Barbados led to his meeting with two mathematical optimisation experts.

Professor Andy Philpott at the University of Auckland School of Engineering and Auckland consultant Dr Geoff Leyland told him that when the weather is uncertain, the straightest route may not be the fastest.

"What you want is a policy that adapts to the weather," Philpott said. Rowers were not allowed to use routing advice from off the boat during the race, so the pair developed an isochrone map based on 20 years of mean wind patterns across the ocean.

Isochrone means equal time, and each line represented a series of places estimated to be the same time away from the finish if the rowers followed the optimal policy from that point. Such maps start at the race destination and are calculated backwards, with each line representing one day's rowing.

Leyland wrote the code that computed the map as a completely new dynamic optimisation problem using a sample-based version of Bellman's equation for dynamic programming.

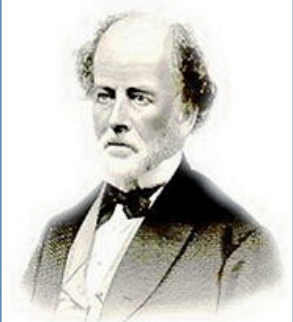
He digitised mean wind directions and entered them into a data file of location and probability. "You pick a point and run through 1,000 possible weather probabilities and how long it would take to row," says Leyland. The software calculated the isochrones using the boat speed.



Top: Biggar, left, and Fitzgerald after their win; photo: Kenny Rodger, *New Zealand Herald*. Centre: The isochrone map, with Barbados on the left. Above: Biggar on a rowing shift, in a still from video footage taken during the race.

Leyland estimated a speed that challenged the rowers to break the world record, which they did, crossing the ocean in 40 days, five hours and 31 minutes.

In his ancestor's wake



Leyland was intrigued to use optimisation in a field that built on the efforts of his ancestor, Matthew Fontaine Maury (1806–1873), an American oceanographer, meteorologist and cartographer.

Maury's *Wind and Current Chart of the North Atlantic* showed sailors how to use the ocean's currents and winds, and drastically reduced the length of ocean voyages. His uniform system of recording oceanographic data was adopted by navies and merchant marines around the world and used to develop charts for all the major trade routes.