

Earthrace

100% biodiesel - 100% carbon neutral

EVERYTHING YOU WANTED TO KNOW ABOUT EARTHTRACE



BREAKING THE ROUND THE WORLD SPEED RECORD

On 20 June 2009, the Union Internationale Motonautique (UIM), the official international governing body of powerboating, confirmed that Earthrace has broken the ten year old Global Circumnavigation World Record. The world ratification number is 3701.

Earthrace completed the 23,497 nautical mile journey on 27 June 2008 in 60 days, 23 hours 49 mins (1,463 hours, 49 minutes), knocking almost 14 days off the previous record held by British boat, Cable and Wireless Adventurer.

The record breaking journey, completed entirely on 100% biofuel, started on 27 April 2008 and finished on 27 June 2008 at the Vulkan Shipyard, Sagunto, Spain.

WHERE IS EARTHTRACE NOW?

Earthrace has just finished a world tour, started in 2006 after she was launched in New Zealand. Over quarter of a million people have been on board, and almost 200 cities and towns have been visited in the US, Europe, Asia, Africa and Australasia. She is now back in Hamilton, New Zealand, home town of skipper and owner of Earthrace, Pete Bethune. The next stop for Earthrace will be joining the 'Steve Irwin' in December 2009 as part of the Sea Shepherd campaign to stop the Japanese whaling fleet in the Southern Ocean Whale Sanctuary in the Antarctic.

THE WORLD RECORD

What was the previous World Record?

The previous record for a powerboat to circumnavigate the globe was 74 days, 23 hours and 53 minutes. This record was set by the British boat 'Cable & Wireless Adventurer' in July 1998.

What were the rules for the record?

The rules of the Union Internationale Motonautique (UIM) who are the world powerboat authority, state that:

- ☐ The boat must pass through both the Suez and Panama Canals
- ☐ The boat can only refuel in ports (no refueling at sea)
- ☐ The start / finish line can be determined by the crew
- ☐ The crew is otherwise free to determine the route, and can choose an east-west or west-east direction
- ☐ The boat must meet CAT1 offshore safety standards
- ☐ The boat cannot be longer than 150ft

What was the world record race route for Earthrace?

Sagunto, Spain – Azores – Puerto Rico – Panama Canal – Manzanillo, Mexico – San Diego, US – Hawaii – Majuro, Marshall Islands – Palau – Singapore – Cochin, India – Salalah, Oman – Suez Canal – Sagunto, Spain (Finish).

What was the weather like during the race?

The record attempt to circumnavigate the globe started in mid April 2008. Up to that time, the Pacific and Atlantic Oceans generally settle down the most. It did not guarantee good weather, and statistically they were expecting at

least two large storms. However, Earthrace was designed for rough seas with waves up to 15m (50ft), and it would have taken very big seas to slow the boat down! The crew had weather reports on a daily basis from our weatherman, Bob McDavitt, from New Zealand. You can see all the daily reports on our website.

How did Earthrace get biodiesel fuel at each of the ports?

The voyage included twelve refuelling stops at various ports around the globe. Our fuel was sponsored by SGC Energia in Portugal, and the ground crew arranged for the required amount of fuel to be shipped to each individual refuelling stop. We made sure we offset our carbon footprint from this through purchasing carbon credits. Shipping the fuel was a huge logistical task for the ground crew – probably even more difficult than being on board the boat!

Crew for 2008 world record attempt

The team was made up of entirely international volunteers. They were:

Boat crew: Skipper, Pete Bethune (New Zealand); Navigator, Adam Carlson (Sweden); Engineer, Mark Russell (UK); and Cameraman, Rob Drewett (UK)

Ground crew: Chief Executive Officer and head of ground crew, Fiona Clark (UK); Operations Manager, Adrian Erangey (Ireland); Chief Engineer, Celestino(Tino) de Freitas (Guyana). This team travelled ahead of the boat to provide the essential logistical support to the boat throughout the record attempt, including: fuel delivery; customs clearance; refuelling; mechanical and engineering maintenance; supplies; media liaison; sponsorship servicing. As with carbon emissions caused by transporting the fuel to the fuel stops (and the biofuel itself), all CO₂ emissions from travel by the ground crew were offset through the purchase of carbon credits.

Base crew: Head of media, Bev Bailey (UK); Administrator, goods and services supplier coordinator, -Ali Bradshaw (UK); Administrator Karolina Romanek (Hungary); Administrator in NZ, Sharyn Bethune. The base crew, working from London, Spain and New Zealand, coordinated international media alongside UK PR firm, Chatsworth Communications, liaised with sponsors and suppliers, began preparations for the continuing Earthrace tour following the world record journey, as well as helped to source and arrange delivery for any unexpected supplies or replacement parts needed by the boat or ground crew.

ECO-EARTHTRACE - what makes Earthrace such an environmentally-friendly boat?

Carbon Neutral: Part of the Earthrace project was to aim to be carbon neutral. This was made possible through offsetting our carbon footprint by purchasing carbon credits. The credits are then used to invest in sustainable projects that reduce CO₂ emissions in the atmosphere, whilst also benefiting local communities in developing nations.

Earthrace carbon offset the following items to ensure that the project was truly carbon neutral.

- All travel made by the team including that of the ground crew before, during and after the record attempt
- Crew incidentals – food packaging for example
- The delivery of all fuel to the refueling stops around the route
- And the fuel itself

Earthrace is full of technology and other innovations that reduce our overall environmental impact

• Earthrace runs 100% biodiesel, which reduces CO₂ emissions by around 78% compared with conventional diesel. It also has fewer emissions in all other categories, with the exception of NO_x

• The antifoul (underwater paint) is completely non-toxic. It is a wax product, rather than the iso-cyanate and heavy metal compounds favoured by most boat builders. This does, however, mean that the crew needs to clean the hull more often than conventional boats



- Earthrace is the first boat in the world to use hemp composite. This is visible on the floor of the helm. Hemp is renewable, unlike carbon and Kevlar, and has some interesting properties making it ideal for medium impact areas
- The hull shape is extremely efficient, reducing fuel consumption compared with conventional craft
- During construction, Earthrace used a number of recycled products (such as ice cream containers) that were collected from local schools. In exchange, the team provided the schools with discarded MDF and pine to use in their woodworking departments
- Some of the lubricants we run are from renewable sources; and our bilge water is pumped through a special filter to remove any petroleum product before it is pumped overboard
- The oil filters are a special serviceable kind that are cleaned and reused

BIODIESEL/BIOFUEL

What is biodiesel?

Biodiesel is a diesel fuel substitute produced from renewable sources such as waste cooking oil, canola and soya bean. It can be produced from the palm plant, but we believe that the harmful effects of palm plantations, often produced by destroying rain forests, mean that biofuel from palm plantations is not an environmentally friendly option. Chemically, biofuel is defined as the mono alkyl esters of long chain fatty acids.

What are the advantages of Biodiesel?

- it is a renewable fuel, unlike fossil fuels, which will eventually run out in the not too distant future!
- if spilt in a waterway, the fuel will be 95% biodegradable within 30 days
- it has the same toxicity as table salt so is safer to handle
- it has an increased flashpoint compared with diesel, so is safer
- it is classed as a non-hazardous so is easier to transport
- it has less emissions in almost all categories compared with petro-diesel
- it reduces dependence on foreign oil
- it should result in increased regional employment
- it retains more foreign exchange earnings at home



What can you make biodiesel from?

One of the great advantages of biodiesel is that it can be made from so many different products including waste cooking oil. In the future, countries will simply use the feed-stocks most suited to their environment. The most common forms of feed stocks used now are canola (Europe) and soya bean (USA), but there are over 350 other crops that can also be used. These include coconut, palm oil, mustard seed, and sunflowers. But you can also make biodiesel from tallow (animal fats), fish oil, and seaweed. New research is discovering new sources of biofuel all the time. Recently, a plant called *Jatropha* that is very hardy and able to grow in areas where other crops cannot grow, has been used, and other groups are investigating the use of algae.

In an extraordinary show of dedication to the project, the skipper, Pete Bethune, underwent liposuction, and the fat removed (100ml) combined with fat liposuctioned from two of his larger friends, was used to make a small amount of biodiesel for Earthrace!

Can Biodiesel run in any vehicle?

Yes, as long as it's fuelled by diesel. Most biodiesel is sold as a blend, where the fuel is between 5% and 20% biodiesel, and the balance from conventional diesel. This is a safe option and most engine manufacturers support this move. Care must be exercised when you first start running biodiesel, however. Older vehicles may need some fuel lines or O-rings replaced to run higher (or purer) blends of biodiesel.

Which countries are currently using Biodiesel?

Most developed countries today have made biodiesel blends compulsory. Between 3% and 5% biodiesel is blended with every litre of diesel fuel they sell. With time, they are gradually increasing these percentages. Biodiesel can also commonly be purchased as a 20% blend. Earthrace uses a 100% biodiesel.

Some countries have used biodiesel as their lubricant additive as they have reduced the sulphur content in petrodiesel. Many countries such as Africa, Asia and South America have active and growing biodiesel programmes underway. Saudi Arabia, for example, is planting crops of Jatropha which will in the future be used as an energy crop, reducing net carbon dioxide emissions by 60-1 (95% degradation after 28 days).

Is biofuel the total solution to world energy problems?

No, it is not the whole answer, but it should continue to be utilised wherever possible, as long as it is made from renewable sources. There are some bad practices and part of our job is to encourage debate and hopefully influence everyone including world governments to find ways to stamp these out.

THE BOAT

What was Earthrace built for?

Earthrace was built by New Zealand company, Calibre Boats, and designed by Craig Loomes -at the request of Pete Bethune, specifically to break the official UIM 'Round the World Speed Record by a Powerboat'. But the most important part of the project was to run exclusively 100% biodiesel fuel, and with a net zero carbon footprint, so that this not-for-profit project could promote awareness of the environment and the sustainable use of resources.

How much did Earthrace cost to build?

Earthrace cost about US\$3 million to build. Of this, Pete Bethune and his wife mortgaged their house and sold up everything they own to make the project happen. This raised about \$650,000, and then they borrowed another \$650,000 from friends, family, and a finance company. The balance was sponsored, mostly in the form of donated goods and services.

How fast does Earthrace go?

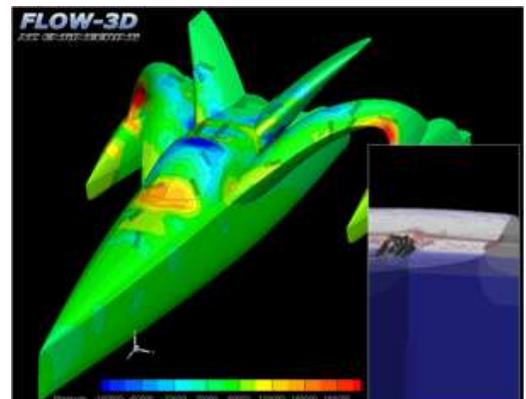
The top speed of Earthrace is around 40 knots (46 mph). When Earthrace attempted to break the 'Round the World Speed Record' however, the goal was to do 20-25 knots (23-29 mph). The challenge was more about keeping the boat running smoothly and efficiently for such a sustained period and beating the record than going at top speed.

What type of design is it?

Earthrace is a wave piercing trimaran. It has three hulls, all designed to go through waves rather than over them. It is also referred to as a stabilized monohull. The design allows this boat to maintain its speed in rough seas as compared to conventional vessels.

How deep does it pierce?

Earthrace has been designed to have up to 7m (24ft) of water on top of the windscreen. This can theoretically be achieved in 15m (50ft) waves; however, in sea trials the boat has so far only submerged to 4m (14ft). The piercing is controlled by pumping up to 2.5 tons of water into a special ballast tank in the bow. The more water in the bow and the faster the boat is travelling, the more it pierces. The only limiting factor is the crew's physical ability to go at high speed into rough seas than the



boat's ability to handle it. In rough seas this boat is awesome (and scary!).

What are the biggest seas it has been tested in?

In trials around New Zealand, Earthrace was twice tested in 12m (40ft) breaking waves. The first was in the Cook Strait with 80 knot (90 mph) winds, and the second was during a storm off the west coast of New Zealand, which saw the boat tested in extreme conditions with huge seas from various directions.

The boat came through unscathed. But for the crew, it is a bombardment of the senses, with violent motions as the boat buries deep inside waves, noise from the waves as they crash overhead, engines roaring, darkness as the boat enters a wave then light as it comes out the other side. All crew agreed that it was the scariest thing they had ever experienced! But it does allow Earthrace to maintain high speeds in atrocious conditions.



Where was Earthrace built?

Earthrace was built in Auckland, New Zealand, by Calibre Boats who specialise in high-tech composite boatbuilding. It was launched on 24th February 2006, and commenced sea trials in May that year. Construction took 14 months and over 18,000 hours of labour. And there is always more work to do to keep the boat in top performance condition!

What is Earthrace made of?

The hull is made from sandwich composites. This involves 40mm of Diab foam core, sandwiched on the inside between three layers of carbon (which allows the boat to be strong and incredibly light), and on the outside between three layers of carbon, one of Kevlar (which gives the hull outstanding impact resistance), and one of e-glass (which is used as very thin fairing layer).

Earthrace Statistics:

Hull type: Wavepiercing trimaran
Length: 24m (78ft)
Beam (width): 8.05m (27ft)
Draft: 1.4m (4ft)
Weight (no fuel): 16 ton
Weight (fully fuelled): 26 ton
Maximum Speed: 40 knots (46 mph)
Range (@ 6 knots): 14,000 nm (16,122 miles/25,928 km)
Range (@ 25 knots): 2,000 nm (2,303 miles/3,704 km)
Fuel capacity: 12,500 litres
Fuel type: 100% Biodiesel sponsored by SGC Energia
Construction: Carbon / Kevlar composite
No of Crew: Four
Beds: Six
Engines: Two x Cummins Mercruiser QSC 540
Gearboxes: ZF Marine 305A (ratio 2.43:1)

What do Earthrace's 'horns' do?

The horns enable ventilation of the engine bay. The upper duct takes warm air from around the engines and releases it outside, while the lower duct takes cool fresh air from outside to the base of the engine bay. This works via a convection cycle. In big seas the horns will go briefly under water, but because the duct is rear-facing, a venturi effect (a constriction in a tube designed to cause a pressure drop when a liquid or gas flows through it) ensures that little water is taken in.

What is the windscreen made of?

The windscreen is 17mm (3/4") toughened laminate. It is effectively two 8mm (1/3") panes of toughened glass, sandwiched together with special resin making it extremely strong and resilient. It will supposedly withstand a hammer dropped from 50 metres (164 feet)... but we haven't tested that!

How much fuel does Earthrace carry?

Fuel tanks are located under the floor in the galley, helm and sleeping quarters. No fuel is carried in the sponsons (outriggers). Earthrace carries 11,500 litres (3,000 gallons) of fuel (one quarter in the day tank and three-quarters in the main tank). So you need to call the bank manager before you fill this boat up!

SGC Energia, Portugal, provided 180,000 litres of 100% biodiesel for the 2008 World Record attempt. The CO₂ produced by both the biofuel and by transporting the fuel to the refuelling stops around the globe is being offset through downwithcarbon.org.



How far can Earthrace travel on one tank of fuel?

It all depends on the speed. At 25 knots (29 mph), Earthrace will travel 14,000 nautical miles (16,122 miles) which is half way around the world. But at that speed you have a very uncomfortable and grumpy crew!

What type of engines does Earthrace have?

Earthrace runs two standard Cummins Mercruiser QSC-540 engines. These were chosen because of their low emissions and the high power to weight ration. The QSC-540 uses common rail, a technology that substantially improves fuel-efficiency and performance while reducing emissions. If you ever buy a diesel vehicle, ensure it has common rail!

Why is there an axe in the forward sleeping quarters?

If the boat ever gets turned over, it's difficult for the crew to evacuate, due to the hatches being underwater. The evacuation procedure is to use the axe to cut a hole in the side of the vessel in the forward sleeping quarters which is large enough to fit the life raft through. The boat is not self-righting, but it will take at least 24 hours to sink...well, that's a relief!



What is in the outriggers?

The outriggers (known as 'sponsons') have virtually nothing in them. They are a series of sealed compartments that cannot be accessed. The sponsons do serve several purposes however. They provide stability that allows the central hull to be very tall, which gives Earthrace its fantastic fuel capacity. They also provide dynamic lift while underway, which aids stability in rough seas, making a full capsize less likely. This encourages the crew to maintain higher speeds in rough seas. Finally, the sponsons ride on the wake of the central hull, making the vessel extremely efficient through the water.

What stops the outriggers from breaking off?

The spars, which are big legs that form a giant M joining under the floor of the fuel tank, and going out to the sponsons. You can see these in the galley when you walk through, and they are painted black against the green galley. The two spars have \$250,000 worth of carbon in them, are 66 layers thick, and took 1,500 hours **each** to make. And if you get attacked by pirates, you can hide behind them because they are pretty much bullet-proof (as we know from past experience!)

Why are the helm lights red?

When human eyes are exposed to white light the pupils close up, reducing effectiveness at night. When exposed to red light, however, the pupils remain dilated, improving night vision. The lights throughout Earthrace can in fact be

switched between red and white, and generally we leave them on red. The lights are all LED-based which is much more efficient than standard lights.

What are the steel tubes that pass from the central hull to the outriggers?

These are the hydraulic lines for the rudders. Earthrace uses a manual hydraulic steering system. There is a rudder on each outrigger and these are angled at 15° from vertical to assist with stability while turning. Despite all this, Earthrace is a difficult boat to dock, partly because of the poor rearward visibility, and partly because Earthrace is designed as a racing boat to go fast, rather than for manoeuvrability.

Where is the shower?

Earthrace has no shower, so after a few days at sea everything starts to smell...and after a week, it stinks! The crew generally don't notice as they live in the environment 24 hours a day, but they do get some noses turned up when they arrive in port after long voyages. Any really reeking crew get thrown overboard for a wash!



What do the designs and artwork on the bow and horn signify?

The graphics were designed by Inia Taylor in New Zealand, who is a fifth generation Maori tattooist. The symbol on the horns represents the environment, with positive and negative changes happening because of man's influence. The bow graphic is a Taiaha (Maori spear), which symbolises strength, power and speed.

THE CREW

How many crew does it take to run Earthrace and what do they do?

For the record breaking journey, Earthrace ran a boat crew of four core crew, but occasionally guest crew (up to 2 extra people) came on board for some of the race legs.

Strict crew rotation was adhered to throughout the record attempt. In normal circumstances, offshore rotation is 2 hours on watch, 6 hours off, one crew member on watch. In high traffic, hazard density or close to shore, rotation is 2 hours on watch, 2 hours off, 2 crew on watch (applies to shipping lanes, inter-coastal waterways, near ports, or where hazards such as marine debris, logs or fishing tackle are evident).

There is also lots of maintenance, cooking, cleaning and other duties to take up the rest of their time. The crew takes several short sleeps per day. They run 'hot beds', where you can choose any bed you like to sleep in, as long as no-one else is in it! The lower beds are more comfortable and there's less danger of injury if you fall out especially as we had new lee cloths from Storrar Marine to keep the crew safe whether top or bottom!

During the record attempt there was also a Ground Crew who travelled ahead of Earthrace to each port to have everything ready for her arrival, including preparations for any maintenance or repairs required, and liaison with media, the public and sponsors at each stop. There were others in the base crew who stayed at HQ in the UK to help with communications between the team, the media, sponsors and supporters, as well updating the website and preparing for Earthrace's return.

There were lots of other volunteers too...hundreds of them, who all played a part in making Earthrace such an amazing project from the very start. These included all those who helped with the first attempt in 2007, the gang who prepared the boat with a complete refit before the 2008 attempt, and others who performed small miracles around the route to ensure the project's success - the Earthrace legends!

Visit www.earthrace.net to find out more

Our 2008 world record sponsors



Official biodiesel sponsor

