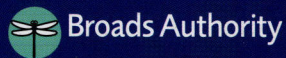


The Journal of the Electric Boat Association
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Volume 21 Number 1 Spring 2008

Electric Boat **NEWS**



**Royal Rewards for Hybrid Boats • Touring in Thailand
A New Solar Boat and a New York Solar Cruise**



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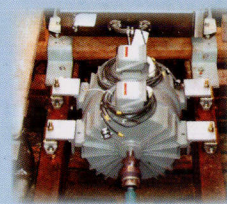
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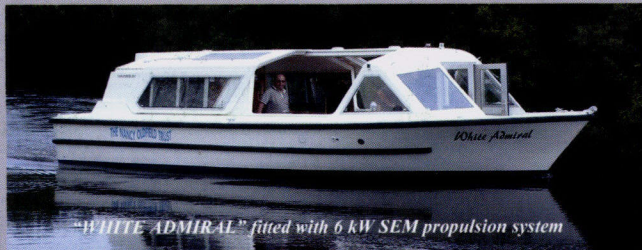
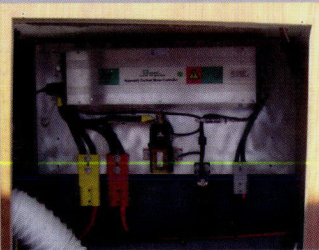
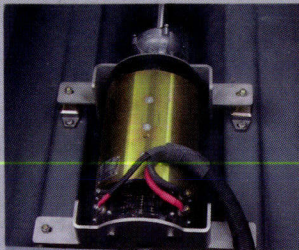
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Royal rewards

Page 2



American adventure Page 10



Swiss science

Page 16

EBA Calendar

May

17th	EBA Event	AGM, Upware, Ely
17th – 18th	EBA Event	River Cam Cruising Weekend
24th – 25th	EBA represented	IWA National Trailboat Rally Tiverton, Devon
28th – 31st	EBA represented	Royal Bath and West Show, Shepton Mallet Somerset

June

6th – 8th	EBA represented	Beale Park Thames Boat Show, Lower Basildon, Berkshire
23rd - 28th	EBA interest	Solar boat race in Friesland, Netherlands

July

13th	EBA interest	Steam and Electric Boating Festival, Sudbury, Suffolk
19th– 20th	EBA represented	Thames Traditional Boat Rally, Henley

August

2nd - 3rd	EBA represented	Great Ouse Boating Association 50th Anniversary, St Ives
23rd - 25th	EBA represented	IWA Festival Autherley Junction
30th – 31st	EBA represented	IWA Campaign Rally Welshpool

September

20th – 21st	EBA event	Norfolk Cruising Weekend
21st	EBA represented	Green Boat Show, Norfolk

October

13th	EBA Event	Laying Up Supper
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Please note that events and dates may change. For more details of the above, or notice of other events, contact the Secretary or check the websites.

Cover Picture: *Kingfisher in Thailand*
see report on page 4

Contents & Editorial

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- the restoration of a 1950s wooden boat

Secretary, Membership Secretary: Barbara Penniall

150 Wayside Green, Woodcote, Reading, Berks RG8 0QJ

Tel: 01491 681449 e-mail: secretary@eboat.org.uk

Details of the other EBA Committee Members are on page 20.

Copy Deadlines:

Material to be considered for inclusion in the next edition of Electric Boat News should be sent to the Editor (preferably by email) by the following date:

Spring 1st June

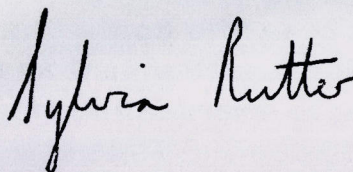


After our appeal for additional sponsorship for the magazine, we were delighted to be offered generous funding for this issue from our President Malcolm Moss, who explains his reasons for 'starting the ball rolling' on page 13. The EBA is talking to other potential sponsors but would be very pleased to hear from anyone else who has expertise

in fund raising or could offer support for our work in promoting sustainable boating.

On the subject of sustainability, we are pleased to report that the printers of EB News have 'gone green' by implementing a series of international environmental standards leading to the award of ISO 14001. By using minimum energy, eco friendly materials and controlling waste, every aspect of their business now has the minimum impact on the environment. Ethedo have also been given accreditation from the Forest Stewardship Council, which promotes responsible forestry and the sustainable use of wood for paper production.

The EBA has a busy programme for the season ahead, starting with our Cambridge Cruising Weekend, including the AGM, in May followed by the IWA Trailboat Rally at Tiverton and the Royal Bath & West Show, with the Beale Park Thames Boat Show in June. After the 'washed-out' summer of 2007 we are hoping for much better weather for this year's boating events.



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Royal Rewards for Hybrid Boats

Loic Lagrange receives the trophy from the Duke. Vice Commodore John Stork and Chairman of the Trustees Jack Edwards are in the background

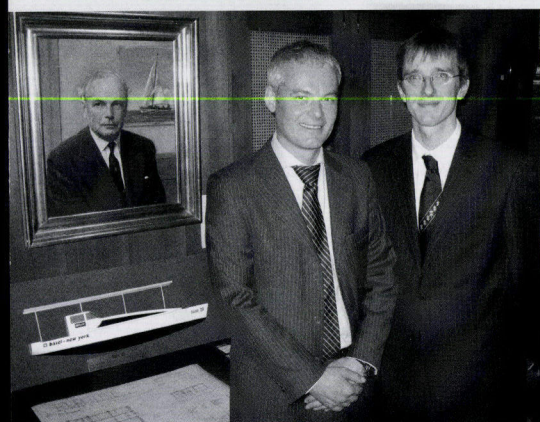
EBA members were among the guests at the Royal Thames Yacht Club on 19th February when the club's patron, HRH the Duke of Edinburgh, presented awards to owners and designers of hybrid boats. The Mansura Trophy and Mansura Medals for innovation in the design, development and operation of boats with hybrid electric propulsion systems, were awarded to competitors from the UK, Europe and Australia.

The original *Mansura* was a 1912 cabin cruiser driven by a petrol-electric hybrid propulsion system developed by her owner, Jack Delmar-Morgan, an electrical engineer and member of the Royal Thames Yacht Club. Kevin Desmond, founder editor of

Electric Boat News, persuaded Mr. Delmar-Morgan's grandson Julian and David Barrett to commission a trophy to encourage hybrid boat propulsion. The Royal Thames Yacht Club promoted and organised the competition with support from the Royal Yachting Association and The Green Blue,

a joint environmental initiative by the RYA and the British Marine Federation.

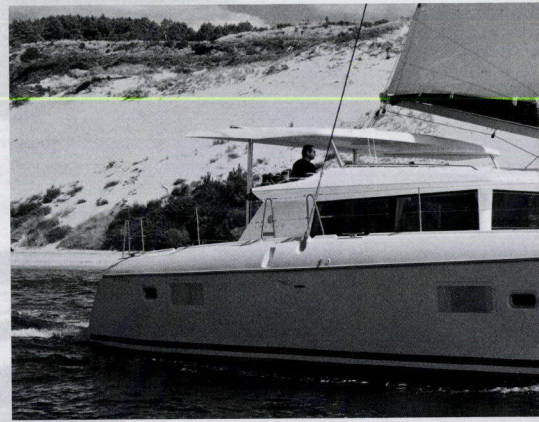
Before the presentation, the Duke of Edinburgh met the finalists and discussed their designs in some detail. EBA Vice-Chairman Ian Rutter showed him photographs of steam and electric launch



Richard Mesplé and Andreas Kindlimann of MW-Line



Jan Labaar discusses the Dutch entries. Greg Powlesland is in the background



Lagoon 420



Solar Sailor in Sydney

Irene and explained the clutch system which enables either the steam engine or electric motor to drive the propshaft via a Poly 'V' belt and pulley. In 14 years of operation Irene has covered over three thousand miles on lakes, canals and rivers in the UK and France.

The Duke also watched EBA business member Graeme Hawksley's demonstration of the offshore hybrid propulsion system used in his yacht Maud, a Wylo 32, described in EB News Vol. 17 No.3 and Vol.18 No.1. Swiss EBA business members MW-Line showed video of their catamaran Sun21 which made the first solar-powered crossing of the Atlantic, featured in EB News last year.

The company also had designs and pictures of other boats in their Aquabus range. The Environment Agency described their patrol launch Colne, fitted with a Selectric hybrid system by EBA business member the Thames Electric Launch Company. Pictures of a variety of boats built or converted by TELCO were also on display.

The oldest boat in the competition was the traditional yacht Collinette which was built in 1885. During 2000-2002 owner Greg Powlesland installed an electric auxiliary system, designed by the EBA's Cedric Lynch, which can charge the

batteries while sailing. Jan Labaar, the editor of the Dutch electric boat association magazine Electrisc Varen, represented the two Dutch entries: the cabin cruiser De Groote Beer, built by Excellent Yachts of Aalst and Hydrogen Xperiance, the first fuel cell boat in Holland.

Although not a competition entrant, electric hydroplane FireFly was on display in the foyer. Owners Helen and Chris Loney plan to make another attempt at the world speed record in the boat later this year.

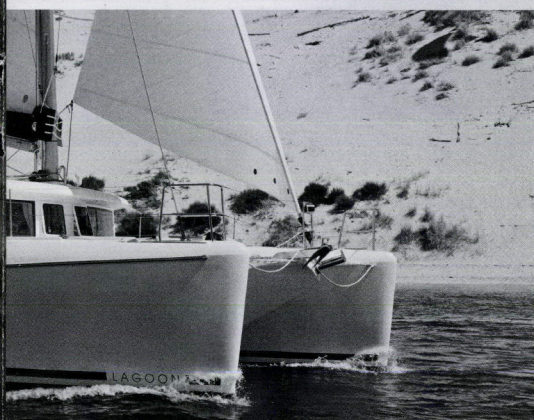
Winner of the Mansura Trophy for 2007 was the Lagoon 420 hybrid catamaran with two electric motors powered by a 17.5 kVA diesel generator. The two banks of six batteries can also be recharged via propellers turned by the boat's speed when under sail. French shipyard Chantier Navale de Bordeaux has built over 60 Lagoon 420s since 2003, half of which have

made transatlantic delivery trips. European Sales Manager Loic Lagrange was highly amused to learn that the trophy, a bronze replica of the tiller head from the original Mansura, was mounted on a plinth made from wood recovered from HMS Victory!

In strong second place was Solar Sailor, which has been operating in Sydney Harbour since the 2000 Olympics. The 100-seater passenger ferry uses rigid photovoltaic sails, which can be tilted towards the sun, to supply its electric motors. There is also a back-up LPG generator for night-time cruises. Solar Sailor Chief Executive Robert Dane was presented with the runner-up trophy, a ship's decanter. MW-Line, Graeme Hawksley, Ian Rutter, Greg Powlesland, the Environment Agency and the two Dutch competitors received Mansura Medals.

The Mansura is a perpetual challenge trophy and there is already interest in the 2008 competition. For more details see the website www.mansuratrophy.royalthames.co.uk

The original Mansura was last heard of on the Rivers Lee and Stort and it would be very interesting to hear from anyone who knows whether the boat still exists.



NICOLAS CLARIS



JANE HAWKESLEY

Graeme Hawksley explains his hybrid propulsion system to the Duke

Touring in Thailand

Barry Stone, who comes from a small fishing town in the West Cork region of Ireland, describes the delights of silent cruising among the wildlife on a tropical waterway.

Kingfisher at the jetty

In late 2004 I founded the Mermaid Cruises & Shipping Company, which in early 2005 moved to the fishing port of Pak Nam Pran, 25 kilometres south of Hua Hin on the west coast of the Gulf of Thailand, an area renowned for its natural beauty.

After trying to run mangrove/river trips using a conventional speedboat with outboard petrol engine, we decided that the noise and smell, plus the pollution, was not good for observing nature and not a particularly pleasant experience for the passengers or indeed the wildlife. I decided that we needed a silent boat and the only option was electrical power. However, I wanted the boat to look like a traditional-style Thai river boat with a long-tail engine – but it had to be high-tech, i.e. made from fibreglass and with an electric motor. The search then began to find someone to do the technical design and build the boat.

It proved impossible to find anyone

with experience in building electrically powered boats in Thailand but eventually we discovered a small company in Pattaya which had extensive experience in building golf cars, using the same electrical technology. With their help a team was formed to construct the boat according to Mermaid Cruises' specifications and install the electrical drive.

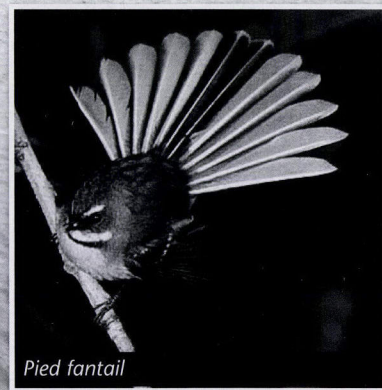
A lot of attention was also paid to the seating arrangements in order to avoid simple rows of benches. The solution was an L-shaped

interactive compartment for up to eight of the maximum number of twelve passengers. The entire project was completed within three months and no modifications were necessary whatsoever after the river/sea trials.

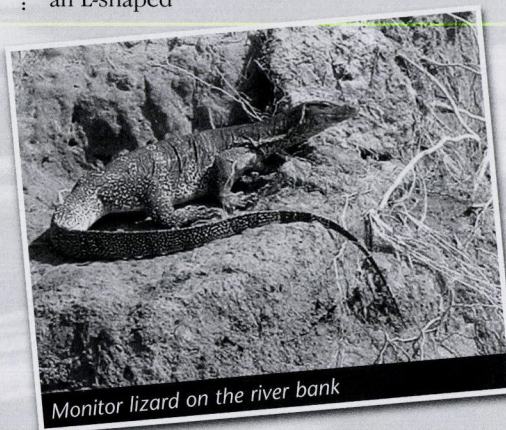
The *Kingfisher* is the first and, as yet, only electric tour boat in Thailand and, as far as we are aware, the first electric long-tail boat in the world. It is virtually silent and creates no pollution. We take visitors on tours of the mangroves at Pran Buri Forest Park and along the Pranburi River to see all the natural flora and fauna there, including monitor lizards up to more than three metres long and over 30 different species of birds, including kingfishers, ospreys, fantails, egrets, herons, swifts and peacocks.

Kingfisher details

Prototype built in Pattaya/Thailand in July 2006, motor and batteries from USA
8 metres long, 1.65 m wide, fibreglass
Upholstered interactive seating, tables,



Pied fantail



Monitor lizard on the river bank

drink holders, soft roof and side curtains
 Draft fully loaded 30 cm
 Seating capacity: 12 plus 2 crew
 Electric motor direct drive: 4.5 HP
 6 x 6 v deep cycle batteries (total 36V)
 Range: 6-7 hours at 4-5 knots
 Recharge time approx. 5-6 hours

In its first year and a half of operation *Kingfisher* has carried almost 1,500 passengers with net returns of four times the initial investment cost. Mermaid Cruises is further extending its commitment to eco-tourism by building an electrically driven minibus to take visitors to and from the *Kingfisher* eco-tours. It is hoped to have a top speed of around 80 km/h, a cruising speed of approx 50 km/h and to be able to cover a distance of up to 200 km between charges.

In addition, Mermaid Cruises is presently constructing Asia's first-ever sea-going electric motor launch, almost 10 m long with room for up to 20 passengers. From mid-2008, visitors to the Hua Hin/Pak Nam Pran area will be able to experience the excitement of skimming across the sea to visit the nearby islands and marine national park. A truly exhilarating experience and yet as eco-friendly as you can possibly get!

What's the next step? We are currently



Electric motor with long tail adapter

looking to improve the *Kingfisher's* performance by modifying the hull design, the power source and the drive system. Any comments or suggestions from EBA members will be most welcome.

For more information telephone 032-632223 (office), 084-8007400 (Barry).
 Email: barry@huahincruises.com or see the website: www.huahincruises.com


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 In Devon

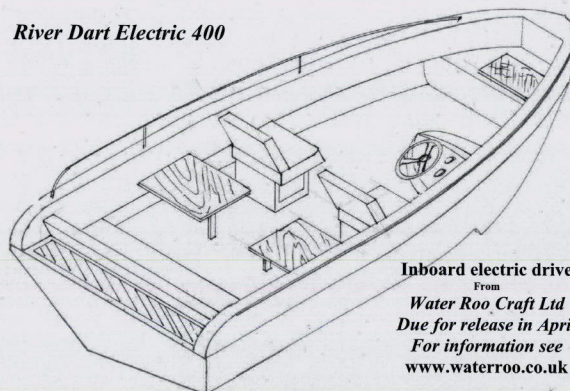
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Planet Savers



A new book by Kevin Desmond, founder editor of EB News, features 301 people from all walks of life who have made a significant contribution to the welfare of the planet. Some are well known including David Attenborough and Al Gore.

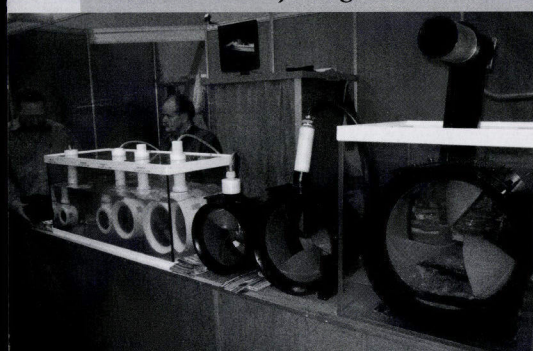
Others, such as the Danish Poul la Cour, who in 1891 designed a wind turbine to store electricity in the form of hydrogen and oxygen, you may not have heard of. The entries are arranged in chronological order from 500 BC up to the present day and most include book references and websites for further information.

The book, ISBN No. 978-1-906093-00-6 is available at £16.95 from Greenleaf Publishing, Tel. 0114 282 3475 or see the website www.greenleaf-publishing.com/planetsavers

New Electric Propulsion System

Electric boat designer Andrew Wolstenholme found an interesting new range of electric drives at this year's Dusseldorf Boat Show. The prototype E-jet comes in sizes from 100 mm (4") diameter to 485 mm (19") delivering from 0.1kW to 60 kW. The motor uses a permanent magnet ring which rotates on ceramic bearings within the sealed outer ring containing the armature. The propeller blades are attached to the rotating ring with the tips pointing inwards. There is no shaft and with the motor under water it should be virtually silent.

For more information telephone +49 (0)2163 9232 0 or see the website www.e-jet.org



Beale Park Thames Boat Show

EBA members will have a variety of electric boats on display at Beale Park at Lower Basildon on the Thames in June, including a mahogany punt, two boats designed for wheelchair users, solar boats, inflatable catamarans and the launch voted Number 3 of the top six boats at this year's London Boat Show. One of the oldest boats at Beale Park will be Bill and Veronica Selby's elegant launch *Serena*, built in the early 1900s.

The show is open from 10 a.m. on Friday, Saturday and Sunday 6th to 8th June. Adult tickets cost £6 in advance or £7 on the day with family tickets at £14 or £15 and free entry for children under 2. You can book on line at www.bealepark.co.uk or on 0118 976 7498.



Electric boats at Beale Park

IAN RUTTER

Windermere Consultation

A public consultation has begun on the future regulation of England's largest lake. The review, by the Lake District National Park Authority, is designed to tidy up the detailed and complex regulations governing what is and what is not permitted for people and boats using the 10.5 mile stretch of water.

The LDNPA's Head of Countryside Services, Mark Eccles, says that views are welcomed from all those who appreciate

and enjoy Windermere. Comments can be submitted by an online questionnaire available through the authority's website at www.lake-district.gov.uk or via a printed form from the LDNPA's head office at Murley Moss in Kendal. Responses, which can be submitted up until 16th May, will remain anonymous and will be received and evaluated by an independent market research company.

River Soar Festival

The 2009 Inland Waterways National Festival and Boat Show will be held at Red Hill on the Soar Navigation, close to its confluence with the River Trent and the junctions with the Erewash and Trent & Mersey canals, just south of Nottingham. The IWA hopes to encourage boaters visiting the festival to try the Erewash and Chesterfield canals and other less frequented waterways of the East Midlands. The annual National Festivals attract hundreds of exhibitors and visiting boats as well as thousands of visitors.

This year's National Festival will be at Atherley Junction near Wolverhampton over the August Bank Holiday weekend, with the IWA Campaign Rally centred on Welshpool the following weekend. The Great Western Canal at Tiverton in Devon is the location for this year's IWA National Trailboat Rally on 24th and 25th May. The EBA stand will be at all these events.



Parliamentarian of the Year



At a dinner at the House of Commons on 1st April, Charlotte Atkins, MP for Staffordshire Moorlands, received the inaugural Parliamentarian of the Year award from the Inland Waterways Association. As well as her support for the waterways movement in general, the award recognised her contribution to the IWA campaign for waterways funding, which included frequent ministerial meetings, winning two adjournment debates, tabling many parliamentary questions and even getting soaked while walking a horse-drawn boat on the Caldon Canal in the rain.

Bob Laxton MP, Chairman of the Parliamentary Waterways Group (of which the EBA is a member) hosted the event within the House on the IWA's behalf. Waterways Minister Jonathan Shaw, Mr. Speaker Martin and twenty other MPs attended the event, along with representatives from navigation authorities, waterways businesses and the voluntary sector.

IWA Vice President Dave Fletcher, Charlotte Atkins and Waterways Minister Jonathan Shaw

Olympic Boating

and opportunities for moving people up Bow Creek and the Limehouse Cut, as well as at leisure boating activities within the Olympic Park. The EBA has suggested to the Olympic Delivery Authority Transport Team that electric boats should be used on the site and is hoping to have a meeting to discuss this in more detail.

British Waterways is preparing a study with the Olympic Development Authority on the feasibility of taking passengers by water to the 2012 Olympic Games. The study will look at connections with the Thames

Lear Electric Boat Arrives in Europe

The Lear 204 electric boat, featured in EB News in Spring 2006, is now in Europe. Lear Baylor of Garden Grove, California announced that the first one arrived in Budapest aboard the MV Talisman in February. The boat has European certification and the company's first European dealer is the Duna Club in Hungary. Their international sales arm is International Trade Associates, who also represent Grady-White and Cobalt Boats.

The 20 ft boat, with six 8D AGM maintenance free batteries, is designed to cruise at an optimum 5 mph for over ten hours on one charge. The retractable hard top can be raised and lowered at the push of a button, securing the boat in 45 seconds. The Lear boat has reached Europe 43 years after the first Learjet executive aircraft, which met with resounding success in the European business world. **For more information see the website www.learbaylor.com**



Solar Flair III – Design, Build, and Launch

EBA Technical Officer Paul Lynn describes the third in his series of solar-powered catamarans.

Tom Lynn welcomes Solar Flair III out of the garage

Those of us who remove cars from perfectly good garages, assuring our families that the space is better employed for temporary boatbuilding, presumably have a certain amount of explaining to do. So what was my excuse? For a start I love designing and making things – boats included – and have a long-term interest in PV and its applications. My previous catamarans *Solar Flair* and *Solar Flair II* convinced me (and I hope others) that solar-powered boating is delightful, perfectly viable in the UK climate, attractive to young people, and need not be unduly expensive. Finally, I had saved the excellent twin-hulls and trailer from the first boat in case of a subsequent mental aberration.

The necessary impetus came from Tony Rymell, our Press & Publicity Officer. Somerset-based like me, his enthusiasm for a new craft to

demonstrate solar boating on the canals and rivers of the West Country was infectious. We decided to share costs and keep them well under control. I was to be the designer-builder, Tony the main user and demonstrator – for me at least, an ideal arrangement.

From the technical point of view I was keen to incorporate lessons from my two previous solar cats and attempt a better-engineered craft with flexibility to incorporate various combinations of PV modules, motors and propellers. We decided to put as much PV as possible along the 21ft (6.3m) length for maximum solar performance, adding a generous amount of instrumentation to allow careful measurements. Hopefully the resulting design would also have something of a wow-factor and help dislodge any lingering impressions that solar boating is impractical or quirky.

However engineering design always involves constraints. I was determined to re-use the saved fibreglass hulls that had been moulded on a 1907 Thames single skiff with an original design loading of one oarsman and a pair of sculls. So once the new boat had two crew on board, all superstructure, PV modules, batteries, motor, and other kit would be 'surplus' weight. Even had I been willing and able to put the PV on a raised canopy, the additional deck space could not have been used for passengers. From an early stage the design was therefore for a light low boat with most

of its length taken up by PV, plus a small cabin area for two. *Solar Flair III* would be the boating equivalent of a two-seater sports car, with space and comfort sacrificed to appearance and performance – and no room for the kids!

We decided to start with a standard electric outboard motor for its convenience, silence and economy. Later we intend to try one of the more efficient new designs that have recently come on the market. This is an important issue because the extra power provided by a generous amount of PV can easily be offset by motor losses. *Solar Flair III's* design specification had by now taken shape:

Length overall:	21ft (6.3m)
Maximum beam:	5ft 6in (1.8m)
PV:	8 x 75W Helios Technology monocrystalline silicon modules.
Charge Controller:	Steca PR3030
Main motor:	Minnkota 74T, 24V with PWM control.
Bow thruster motor:	Motorguide 12V, 22A.
Batteries:	Minimum 2, maximum 6, each 12V 40Ah.
Launch weight:	240kg

A few extra points are worth making. The boat's nominal PV power of 600W is double that of my first solar cat and should give about the highest Solar Boat Index (SBI) in the EBA fleet. I decided to include a second, much smaller, motor as a bow thruster because previous



Cockpit controls and instruments

experience had shown just how difficult it is to turn a solar cat around on the upper stretches of the River Thames, let alone on a canal. The battery capacity (for the initial trials just 40Ah at 24V from two small batteries) may seem meagre, but remember that the more PV you have the less battery power you should need – assuming something like ‘normal’ summer weather!

After clearing the garage of unwanted encumbrances, the twin fibreglass hulls were supported on trestles and building commenced. Restricted space and light made photography during the construction phase very difficult, so the first clear evidence of creative activity had to wait until the boat was coaxed out of her lair in early August 2007. This coincided with about the wettest period of summer weather in living memory, making it difficult to finalise arrangements for the tow and even harder to imagine an enjoyable, sun-filled, launch.

Fortunately the clouds took pity on us. My brother-in-law Humphrey Foster and friend Harry Oliver helped to trail the boat to the Bridgwater & Taunton Canal where Tony Rymell's local knowledge had suggested an ideal stretch of water for the launch and initial trials. Family and

friends gathered for the occasion in superb weather and we ran *Solar Flair III* back and forth many times over a 300m stretch of canal, timing each run with stop-watches and estimating speeds for various values of motor current. Initial results were very encouraging: with two crew aboard a 14A draw (340W at 24V) was enough to reach the canal speed limit of 4 mph (6.4 kph). A draw of 21A (500W) gave close to 5 mph (8 kph), which is the limit on the River Thames although a bit naughty on a canal. Increasing the motor current further had little effect on speed, nodoubt because the standard prop fitted to the Minnkota outboard had the usual small pitch and we were running out of ‘pitch x revs’. A prop with greater pitch should significantly improve performance.

Yet even with the standard motor and prop the boat can claim a very good Solar Boat Index (SBI). As a river boat cruising at 5 mph, our results give an SBI of 3.6; as a canal boat for which 4 mph is the standard speed, it works out at 5.4 (for a definition of the SBI, see *Electric Boat News* Vol.18, No.4, Winter 2005/06). These values will doubtless improve with a more suitable prop, and especially with a more efficient motor, and should

make *Solar Flair III* by far the most generously solar-powered catamaran in the EBA fleet.

Following *Solar Flair III*'s successful launch, Tony Rymell enjoyed a lengthy cruise with his family on the Bridgwater & Taunton canal, demonstrated the boat at water festivals in Tiverton and Taunton, and trailed her to the Green Boat Show in Norfolk in September. This year she is due at the National Trailboat Festival on the Grand Western canal and the Royal Bath & West Show near Shepton Mallet as part of the EBA display, so with luck our aim of introducing electric and solar boating to a West Country audience will be in full swing.

And how about the wider world? I can hardly pretend that my third cat would cause a sensation in Australia or on the lakes of Southern Germany or Switzerland, where there are plenty of high-performance solar boats. But here in England, where we are some years behind with PV applications including boating, perhaps *Solar Flair III* will play her own small part in encouraging more sustainable transport on our inland waterways.



Afloat at last

The Launch Party

New York Sunshine Cruise

Canadian EBA member Monte Gisborne describes his journey across New York State at a cost of only half a dollar a day in fuel.

Deanna, Denise and Monte on board the Loon

At 10 a.m. on 26th October 1825, New York Governor DeWitt Clinton stood proudly before the people of Buffalo. Fingers in ears, he and the gathering prepared for the loud explosion as the cannon fired, signalling to the world that this magnum opus, the product of over 50 years of planning and construction, was finally a reality. With a resounding boom the sound travelled to the next community, whereupon another cannon was set off, repeated all the way down the line until the sound reached New York City three hours later. After a huge artillery salute, the message was returned in the opposite direction and the Erie Canal was open for business. Spanning 363 miles across the Empire State, it was created primarily for commercial and peacetime purposes – to encourage inland development and promote migration away from the congested Atlantic seaboard.

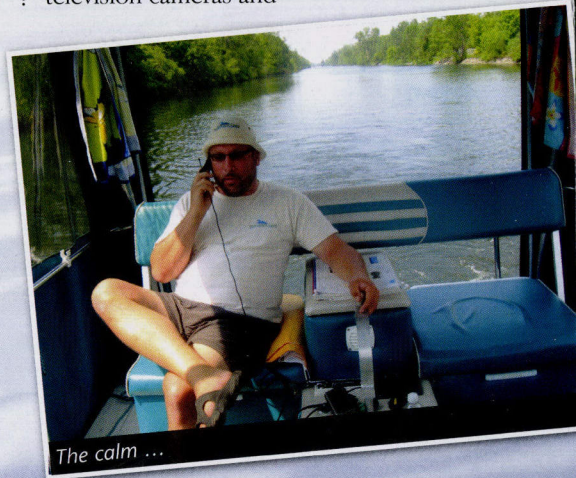
It is not difficult to imagine the present day canal with a packet boat (for passengers) or a scow barge (freight only) pulled by mules from the towpath. Much of

this original heritage is preserved for modern day use, now almost exclusively recreational, although there are proposals for a return to commercial shipping along the route. The New York State Canal System has been expanded with opportunities to venture off the original plan into areas like Oswego and the Finger Lakes, as well as to Champlain Lake in the north and into Canada. It is an undiscovered gem and, like most recreational waterways in the world, dramatically underutilised by potential vacation-seekers, even though more than 80% of New York's nearly 20 million people live 25 miles or less from the waterway.

Having travelled the Trent-Severn in 2005 and the Rideau Canal in 2006, we were up for a greater challenge in 2007. The New York State Canals seemed to offer just that, and a boatload of history as well. My faithful crew of my wife, Denise and our 10-year-old daughter Deanna eagerly volunteered for the assignment, especially when Deanna heard that we would be visiting Sylvan Beach, an

historic amusement park along the way. The trip promised something for everyone with regular stops on the 12-day journey.

On August 12th we launched from Oswego, a port city on the shore of Lake Ontario, in the same solar-powered Loon boat that had travelled the Rideau Canal the year before. Although our company has produced seven Loons to date, in use in Mexico, Belize and Canada, none had been taken on a continuous trip of this duration averaging just over 20 miles per day. The New York State Canal Corporation was delighted to hear of our adventure, the first of its kind on their historic waterway, and mobilised their public relations team. With television cameras and



reporters covering the launch, we set a course for Waterford, over 250 miles away, which would take us along the Oswego Canal and then on to the Erie Canal proper, crossing Oneida Lake, the largest lake in the state.

Living aboard the boat was hardly roughing it as we had a microwave oven, refrigerator, barbeque, stereo and other amenities. At night, the two side benches were filled in with cushions to make a comfortable queen-sized bed, and an air mattress, on which we took turns, was sufficient for the third person. Perhaps the greatest challenge was storage space, something to be dealt with on future vessels. An important aspect of these cruises is to generate ideas to improve the boats.

Oneida Lake is a large but shallow lake, so swells kick up with little provocation. It also has a number of unmarked shoals and, since the level of the lake is controlled, they can magically appear with little notice. We suddenly met one, finding ourselves stuck on top of a shallow, rocky area. With 18 inch high waves pushing into the side of the boat, I decided that the smart idea was for me to get out, eliminating about 210 pounds of down force on the vessel. I was then able to grab hold of the side of the boat, walk with it about 200 feet and 'launch' it off the shoal. A few thoughts occurred to me about the design of the Loon which made such light work of what could have been an awkward situation:

1.The slower speeds associated with electric boats minimise danger.

At about five knots, my effective cruising speed, the boat would sustain much less damage when hitting the shoal than a boat travelling at 20 knots. No damage to the hulls or propulsion system was sustained.

2.The kort nozzle, a clever shroud which protects the propeller, prevented any damage to the prop.

If the prop had been exposed (which is the norm) it would have been bent and likely rendered unusable.

3.The twin hull design of the boat allowed it to remain on the shoal in a perfectly horizontal position, to the relief of my crew on board.

A conventional monohull would quite possibly have tipped over, given the waves lapping against it from the side. A 'V' planing style hull would certainly have tipped over.

As in previous solar cruises, we took

advantage of charging at the marinas we stayed at, drawing about 50 cents (25p) worth per day in shore power electricity, about half the energy required, with the 720-watt solar array providing the balance. You get into the habit of plugging in when you arrive (I would often wait until dark to help lower the state's peak load) and the next day the boat is fully charged. Ending the day with around a half charge left in the batteries goes a long way towards stress-free boat operation.

The classic goof-up moment occurred when we left the boat to go to the fun and frivolity of Sylvan Beach. The lack of secure storage space forced me to make a dumb decision – to hide my expensive GPS system in (of all places) the microwave oven to evade would-be crooks. You guessed it – one of my crew (who shall remain nameless) decided to whip up a culinary treat and fried my GPS instead!

Making our way down some of the most beautiful stretches of scenic waterway we have ever seen, we could not have asked for more beautiful sunny weather, at least until Day 9 when the temperature dropped and the clouds rolled in. This pattern held



The last lock

during the only 'challenging' part of our trip, a 30-mile stretch from Amsterdam to Schenectady in strong headwinds and no appreciable sun, both declared enemies of the solar boat. To add to the challenge, there is hardly sign of life anywhere and an 'opportunity charge' would not have been available if required. The weak canal current in our favour did little to offset the greater factors working against us, but we arrived with some reserve power left, although thankful to be there.

The last morning of our trip was the most miserable of all. Lots of rain and overcast skies as we set off for a planned press conference in Waterford to show a boat powered by the sun. But as we descended the famous 'Waterford Five', a five-lock system which takes you down



... and the storm on Oneida Lake

the hillside of Saratoga County, something miraculous happened – the sun came out and the winds died. When the final large steel lock door creaked open and spilled out its contents, namely us, we were overwhelmed by the turn-out.

Television cameras were everywhere and photographers scrambled from bridges and walkways to catch the best view. The podium and press area was quickly set up outside in the glorious sunshine and area politicians and government agency spokespeople, including New York State Canals director Carmella Mantello, spoke passionately about the vision of zero-emission boating. Also invited were the New York State Energy Research and Development Authority who made a great presentation about needing to take these ideas seriously if we are to make a difference to our global environmental situation.

Then I was invited to submit a competitive application on behalf of my company for state funding to develop my solar boat in New York State.

After considerable effort, with an all-night session reminiscent of my university days, I dropped off my application at the end of September. Just before Christmas I had the shock of my life when I was informed that I had been successful in the competition and beaten 32 other companies for the \$500,000 grant money offered.

This puts us in a great position to develop the Loon solar boat, drawing from the experiences and ideas generated in the past three years. Production facilities are being considered in Central New York, probably around the Erie Canal itself. With this renewed enthusiasm and capital injection, we are now preparing to relaunch the Loon in the summer of 2008 with a great number of enhancements and improvements. We'll keep you informed, but most of these developments will be regularly posted on our web site www.tamarackelectricboats.com.



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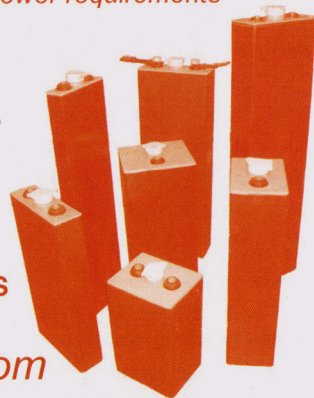
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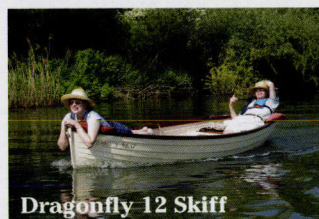
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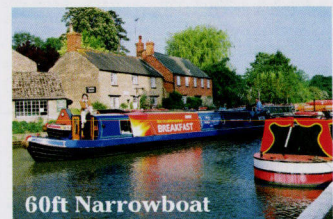
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Support for Sustainable Transport

EBA President Malcolm Moss, the founder of the Moss Solar Trust, explains his reasons for sponsoring this issue of the magazine and his support for solar power.



Why are you doing this?

To set the ball rolling on sponsorship of the magazine. The Executive Committee wants to increase both membership and our voice in the boating world and would prefer not to increase subscriptions. Assistance with extra funding, such as sponsorship of the EBN, will be very welcome.

What is the Moss Solar Trust?

A registered charity in India, whose main objective is to promote the use of solar in sustainable transport to mitigate the affects of climate change. We give small donations to get projects moving and lend electric motors and panels to individuals in the expectation that the experiments will be reciprocated. In the UK we fund projects directly to save the problems of money transfer in and out of India.

Is climate change such a worry?

Categorically YES. The world, over millions of years, has been in a relatively stable balance of carbon dioxide in the atmosphere to that sequestered as wood, later to become the fossil fuels of coal, oil and natural gas. Over one century we have reversed this process, releasing excessive quantities of carbon dioxide which forms a greenhouse effect above the earth. We have put the world atmosphere into an unstable state, like a glass of water tilted at 30 degrees. The glass will probably fall back, causing just a little spillage and waves, but if nudged will fall over. So any extra phenomenon hitting the world will have catastrophic consequences. Governments take it very seriously, acting even at the expense of the economy, but more needs to be done by individuals.

How are EBA members helping?

Every time an electric boat is used, or on display, it demonstrates to others that electric boats work and adds to the technical knowledge of electrical storage, management and propulsion systems. Adding solar panels makes the boats more sustainable. Every new boat increases the knowledge base and greater numbers will lead to lower prices and more availability. Driving electric boats teaches us all about the use of power, which is a scarce resource and must not be squandered.

Is solar power economic?

Sometimes. To put solar photo voltaic (PV) on houses is good for climate change, but rarely gives a reasonable financial return. Do not, however, let me stop anyone doing it as it is reducing carbon dioxide emissions. When PV is used in transport it is more economic, as the power produced competes with taxed petrol and diesel.

What is the best use of solar power?

Probably boats. There are now several solar ferries which carry over 100 people and the technology is well proved. Leisure boating tends to be done in fine weather, so the solar charging often provides all the power, but there is no reason why hybrid power systems should not be used. The knowledge acquired from solar boats is now being put to use on electric cars, especially the new plug-in hybrid electric vehicles, which will get up to 20 miles per day from solar charging but still have petrol motors for long journeys.

Is solar the best form of sustainable transport?

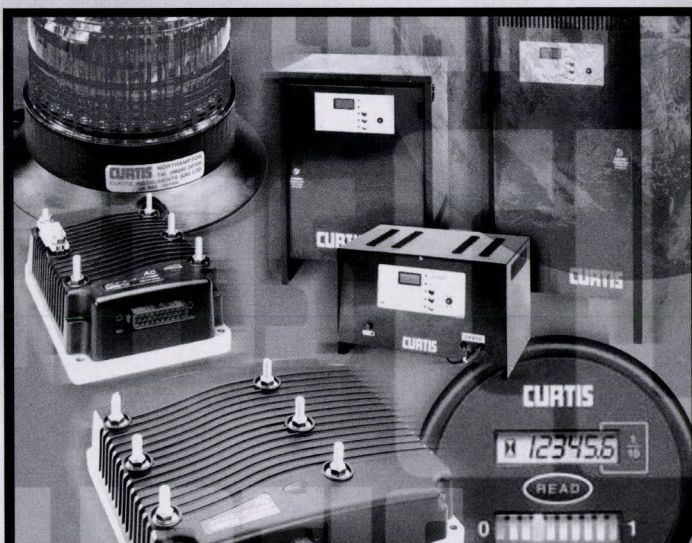
Interestingly, at last year's Royal Bath and West Show it was solar that took all the main prizes in spite of competition from other sustainable power sources such as hydrogen, biodiesel, bioethanol, plant oil, biogas and electric.

Tell us about some of the current projects of The Moss Solar Trust.

The latest project updates can be seen on www.mosssolar.com a website prepared and managed by the EBA's Nick Goldring. We are encouraging the building of solar boats in Kerala and planning a new solar boat for Udaipur, where the world's first commercial solar water taxi operated. Last year we sponsored the Sustainable Transport display at the Royal Bath and West Show where the EBA stand was manned by the hard working team of Barbara Penniall, John Hustwick, Tony Rymell and Ian Macnab. This year we have built a solar powered wheelchair to accompany Annie Maw, the High Sheriff of Somerset, on her SolaRola Adventure from London to the show, which runs from May 25th-28th, and all support is welcome in running the EBA stand or just visiting. Our solar boat the SB Collinda will act as a mobile solar charging station for the six solar wheelchairs. We are also building a solar powered quadricycle to act as a support vehicle.

Can we make a difference?

European governments including our own are taking climate change seriously but they cannot dictate individuals' purchasing decisions and large corporations will only produce to satisfy demand. By spreading the news about electric and solar boats EBA members can create demand and alter legislation for inland waterways.



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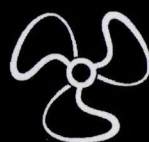
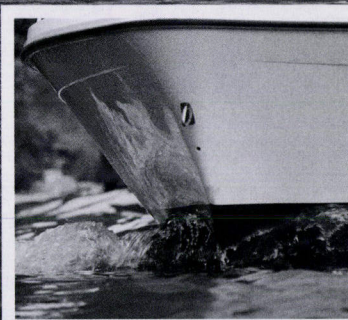
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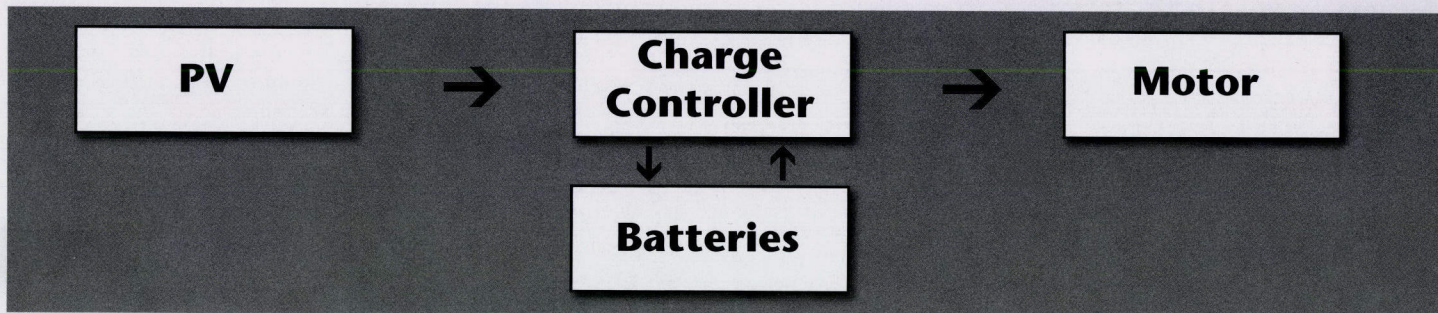
Technical Report

ELECTRIC POINTS: 'FROM PHOTONS TO PROPULSION'

In the twelfth of a series of short articles on technical aspects of electric boating, EBA Technical Officer Paul Lynn discusses the electrical circuit of a solar boat.

My previous article in this series, 'Cruising on Sunlight', described the various types of photovoltaic (PV) modules currently used in solar-powered boats and discussed the amount of PV power needed to achieve a desired level of performance. I should now like to follow this up by describing the interconnection of PV modules, batteries, and motor using a *solar charge controller*, also known as a *charge regulator*.

The basic scheme is shown in the figure. The charge controller's task is to regulate current flows in the system – from PV to batteries and from batteries to motor. This immediately raises the question why a special controller is needed at all. Why can't we simply connect the PV directly to the batteries to allow charging whenever there is sunlight, and connect the batteries to the motor via a switch whenever we want to start cruising?



The basic answer is that we need to protect the batteries and prolong their life. The charge controller prevents *over-discharge* by automatically disconnecting the motor (or other loads) whenever it senses that the batteries have reached a certain depth of discharge. At the other extreme it stops the PV from *overcharging* the batteries by limiting the charging voltage. It also prevents *reverse current* being fed from the batteries back into the PV at night.

Solar charge controllers normally have additional functions, depending on power rating and price. These may include:

- Display of important parameters such as battery voltage and/or state-of-charge, PV charging current, and load (motor) current.
- Different charging regimes for different battery types.
- Equalisation charging and temperature compensation.
- Overload and short-circuit protection.

The first of these features is especially useful. A good charge controller provides, at quite modest cost, a display of all the system parameters you need to check the electrical health of your solar boat, without any need for additional instruments such as voltmeters and ammeters. It is your adviser as well as protector.

Solar charge controllers have been developed over many years for what are known in the PV world as stand-alone systems – in other words, PV systems which are self-contained and not connected to a

power grid. There are now millions of these in sunshine countries of the developing world, mostly providing small quantities of solar electricity to individual homes and buildings far removed from an electricity grid. In the simplest cases a small PV module and a single battery are used with a cheap charge controller to supply a few low-energy lights and probably also a television. We are talking here of a few tens of watts. Much of this market is now satisfied by low-power controllers manufactured in the countries of use.

Stand-alone systems in developed countries range from low-power applications such as illuminated roadside warning signs (sometimes with a small wind turbine as well as PV) up to bigger and more powerful systems – for example, roof-top PV arrays supplying solar electricity to substantial homes and buildings. Here we may be talking about power in the kilowatt range requiring more sophisticated, and expensive, charge controllers.

Moving now to boats, an ever-increasing number of conventional boats use a PV module or two to provide small amounts of electricity for trickle-charging batteries or running electronic equipment. Charge controllers for such applications are widely available and cheap – say under £30. But solar boats are more demanding; a small solar-powered craft might need a few hundred watts of PV and motor power, and a solar controller handling up to 30A at 12V. Such a unit, typically designed in Germany

and made in China, can be bought for well under £100. For this price you get comprehensive monitoring of such parameters as battery voltage and state of charge, PV and load (motor) currents, as well as battery protection.

For larger solar craft with higher system voltages and/or power levels, controller prices tend to rise fairly steeply. For example, whereas a 24V 40A (1kW) controller can currently be bought for about £150, a 48V 60A (3kW) unit will probably set you back more than £500. Note, however, that such prices represent only a very small fraction of the total system cost. The more expensive units often incorporate maximum power-point tracking (MPPT), a sophisticated control algorithm designed to extract the maximum amount of power from the PV in variable sunlight.

In some cases it is attractive to install an intermediate amount of PV to extend cruising range. For example if you own a boat with a 3kW motor, you might decide to purchase 300W of PV making the boat 'solar-assisted' rather than 'solar-powered'. A 300W controller will now be adequate – and save money – as long as you realise that the motor must have its own separate connection to the batteries.

Whichever charge controller you choose, it will surely play an essential role in battery protection and system monitoring all the way 'From Photons to Propulsion'.

Noticeboard



Welcome to New Members

Private Members	Location	Boat where notified
Dr Charles G Johnston	Plymouth, Devon	
Philip Rowley	Whitchurch-on-Thames, Berks.	Zanzibar, Frolic 31
Jurgen Rosemund	Berlin	
Jack Street	Redhill, Surrey	Grabachance, Seahopper folding dinghy with electric outboard
Peter Davies	Bristol	
Pat Jordan-Evans (welcome back Pat)	Ewelme, Oxon	Vanda-Belle, Frolic 21
Terry-Anne Stevens	Chertsey, Surrey	Family A Fayre, Frolic 21

Business Members

Torqueedo	Lowestoft
Manufacturers of Torqeedo outboard propulsion systems	
Perfect Yacht Consulting	Windsor, Berkshire
Consultants to boatbuilding industry	

Dear Sylvia

In my search for help with my batteries and charging, I have received very useful advice from Dave Millin (of Pb Batteries). I have also spoken to Chloride Motive Power to get more information.

In searching the web I came across an excellent document from Victron Energy. They will send, free of charge, their booklet 'Energy Unlimited', which gives a comprehensive explanation on batteries and charging. On their website, go to 'Support and Downloads' and then 'General Technical Information'. The piece on 'equalisation' of cell unbalance was particularly interesting to me.

Before significant investment in a new 30 amp high frequency charger, I have just bought a 24 volt CTEC Multi XT 14000 charger, at about £200 (from www.vertar.com but available from others as well). I will charge my four Elecsol batteries two at a time, and this has worked well for the first try. It also claims to float charge all four, connected for 24 volts.

In my employment with the Environment Agency (I am now retired) I came across a lubricant for mechanical and electrical purposes, Aqua-lube 250, from Metalyte Ltd. which claims to protect against moisture and corrosion. I have bought five cans for my own use. At the start of last season I sprayed all round the motor and electrical components and wiring connections. Their technical support said there was no problem spraying inside the motor and they recommended using it each season.

It is difficult to assess, but I certainly experienced no problems last year, and I regard it as 'preventative maintenance'. A 400 ml aerosol can costs about £20, although they sell them by the box of 10 cans (or in bulk 5 litre containers.) Via Google they appear under

IMG-metalyte Ltd, and are based in Dorking; my sales contact was from Cheshire on 01270 611031.

Your sincerely,

Pat Brady, Sunbury on Thames



Annual General Meeting

This year the AGM moves from the Thames to the intriguingly named Five Miles from Anywhere No Hurry Inn at Upware in Cambridgeshire. After a pub lunch members can join a short cruise to Ely, with a cruise to Cambridge on offer for the following day. More details and a map are on the EBA website, or contact Barbara Penniall.



Help at Shows

Would any members who can bring a boat or offer help in manning the EBA stand at boat shows please contact Barbara. The first two shows of the season are both in the West Country, so you could combine a trip to the Trailboat Rally in Devon with a visit to the Royal Bath & West in Somerset.



Grantham Canal

The Grantham Canal Society is hoping for permission from BW to operate boats on the restored top length of the canal during some weekends in 2008. Boaters interested in cruising the four miles through the beautiful Vale of Belvoir should contact Barbara.

Dear Sylvia,

I was interested in the fascinating description of the hydrogen boat in the last issue as I built a semi-amphibious solar-hydrogen powered hybrid vehicle in 1991, in a research project financed by the Swiss government. Actually it worked best in battery electric mode and I never used the hydrogen in the boat mode. Fuel cells were very expensive then, so the hydrogen was used to power a four-stroke i.e. engine, very loud and prone to catch fire. The efficiency and practicality in this mode was much worse than electric, yet the maximum range per charge was higher.

I believe that pressure vessels can be a better way to store hydrogen than metal hydrides, both weight and safety-wise. 200 bar steel bottles are extremely tough and reliable and I guess of the same order of mass as the 10 bar bottles filled with metal hydrides mentioned in the article. Other materials such as carbon fibre allow further weight reduction but cost a lot more. In my project I was able to fabricate kevlar-reinforced bottles but unable to use them because the required destructive testing became very involved. So I used standard steel bottles and built a nearly isothermal compressor with input from the solar electrolyser (working pressure 30 bar) and output of 200 bar to the bottles. This used only a small fraction of the power stored. The electrolyser is a device to split water into hydrogen and oxygen using electricity, in my case from roof-top solar cells.

My electrolyser was quite large and heavy and so was not carried in the vehicle. Reversible solid state devices do exist which can be used both as fuel cells and as electrolyzers. Indeed, nickel-metal hydride batteries are in a sense just this, with metal hydride storage built in to the casing as well! The main thing about hydrogen storage is that presently it is cheaper to extract hydrogen from fossil fuels than make it from water using electricity from solar or wind power, so there is ecologically no point in large scale hydrogen storage until we have sufficient sources of renewable electricity. However I think we must push renewable hydrogen as a complement to battery storage to avoid problems from the overuse of agricultural fuels. In any case we must strive for pure electric propulsion for the frequent shorter journeys and chemical storage only for range-extending when required.

Best regards,

Theo Schmidt, Steffisburg, Switzerland

The experimental vehicle is pictured on the inside front cover

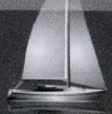
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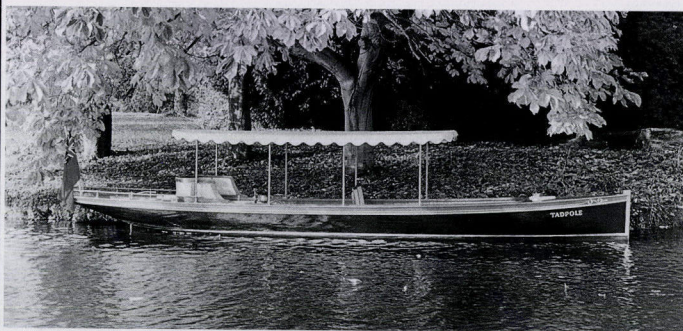
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Paul Lynn and Tony Rymell,
whose contribution to the EBA Executive
Committee has been very much appreciated,
will not be standing for re-election at the AGM.

The good news is that Paul will continue to write
articles on solar power for EB News and Tony
will continue to represent the EBA in the South West
but we are now looking for volunteers for the positions of

Technical Officer

and

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Just untie and unwind



La Petite Souris

EBA member Chris Evans describes his restoration and conversion of a 1953 mahogany cruiser.

I think it was love at first sight when I saw a picture of La Petite Souris for sale in the summer of 2003, even though the owner, Peter Messing, explained that it was in need of major repairs. He was extremely open about the faults, including an extensive area of rotten wood in the inner skin of the hull beneath the galley, and various soft spots in the cabin sides. The outer skin was sound, however, and the sale was agreed, including a price for Peter's son Colin, an experienced boat builder, to repair the inner skin. My wife and I were able to do some work on the boat before we had to return to our home in southern Germany.

In November the boat was lifted out at Windsor Racecourse Yacht Basin for one month and I returned to clear out the galley and create a clear access for Colin to get to all the rotten wood. The interior fittings were all dry screwed – that is without any glue – so it came apart very easily. I then tackled the cause of the inner skin decay, which was rainwater seeping in from a joint behind the saloon where the curve of the roof allowed it to trap in a corner. My first idea was simply to drill a hole to drain it, but this would have been unsightly and might have created another soft spot around the hole. I solved the problem by creating a triangular wedge that fitted in the corner and diverted any rainwater away from the water trap.

I found some rot on the plywood roof panelling which had to be replaced with

sound wood. I cut suitably shaped pieces of $\frac{3}{4}$ " plywood to deflect the water and glued that in place with epoxy resin. Next day I primed the bare wood of the roof panel with epoxy resin which I allowed to gel off (begin to harden) before applying a layer of fibreglass and polyester resin to give a protective covering.

Then it was time to get out the scraper and start on the bottom. Boats always look bigger out of the water, and they look even bigger when you have to scrape the entire bottom. My next door neighbour kindly offered an old mattress for me to lie on which was a great help. I tried to work so that the breeze would carry the dust and scrapings away from me but when I showered each night the water ran red with the dust. It was a mucky job but I made good progress and completely scraped below the waterline in two days.

Colin and his brother Stephen made a fine job of the repairs and my wife flew over to join me for a couple of weeks, doing excellent work in scraping off old paint and varnish.

Another messy job was to clear the bilges of the filthy black engine oil leaked from the old Perkins 4108 engine. I used a vacuum cleaner attached to an old garden sprayer container, fitting the hose with a piece of metal pipe flattened in a vice. I then poured the oil emulsion into a large flower pot with a hole in the bottom and three quarters filled with sharp sand, allowing the water to drain through while

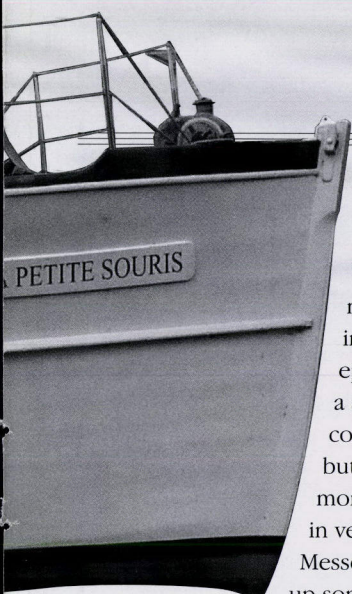
the oil remained on top to be scraped off and disposed of.

The bilge in the engine bay was cleaned and pressure washed and allowed to dry out for painting later. The outside of the hull was given a coat of undercoat and then a coat of white gloss. The propeller was detached and sent off for reconditioning and a new cutlass bearing was installed in the P bracket. While doing this I noticed that the P bracket seemed a little loose and when I tried tightening the four bolts that attached it to the hull I discovered that three of the four were broken in half. Four new stainless steel ones were installed.

With all underwater work carried out I could concentrate on important work topsides. I set to routing out soft wood from the wheelhouse/saloon cabin sides



Below decks



and letting in new Iroko glued in place with epoxy. There was a substantial colour difference but after a few months it toned in very well. Colin Messer had machined up some mahogany tongue and groove

boards for me and I was able to begin rebuilding the damaged bulkheads. I changed the layout of the stern cockpit and had a new cockpit hood made up to my design. My wife scraped the forward cabin down to bare wood ready for primer and finishing coats before starting on the varnish work.

When the boat was launched and moved to its winter berth at the marina it was disconcerting to see large amounts of water filling the bilges, although I know from experience that this is quite normal for wooden boats which have been out of the water for some time. I had installed three electric pumps with float switches and they all worked well. I was relieved to note that the water subsided to a satisfactory amount within a couple of days.

A week later, with my estate car loaded to the roof and beyond with items of interior joinery for rebuilding or replacing in my workshop, I set off for home. There were doors, steps from the forward cabin and steps from the galley, drawers, lockers and bunks. They would keep me busy through the coming winter months.

Returning in the spring of 2004 with a new galley in flatpack form, I installed two solar panels providing a maximum of 4 amps each. This proved ample to keep the two large batteries charged even with the refrigerator running full tilt.

One thing that became blatantly clear was that I had to do something about the old Perkins diesel. I had a brand new Ford Marine engine at home in Germany which would have been

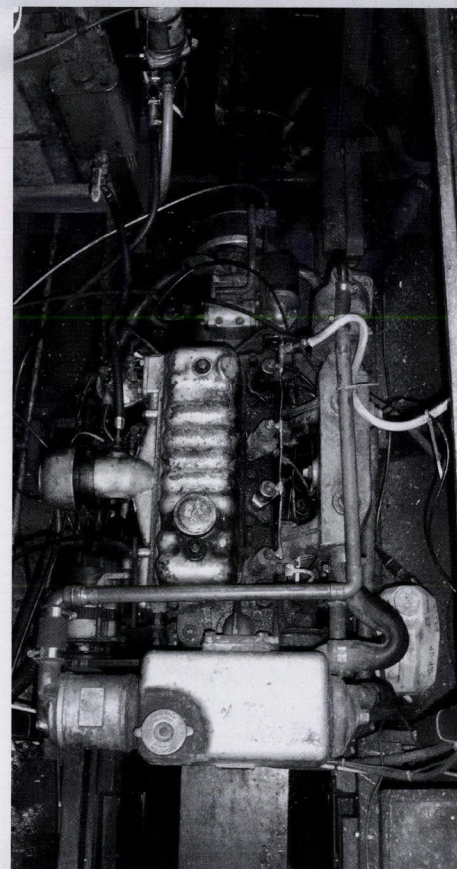
powerful enough and I seriously considered swapping it for the Perkins. But I was concerned about the noise of a diesel in this old boat. At the Traditional Boat Rally I met John Hustwick of the Electric Boat Association and picked up some pamphlets from him on various conversions to electric power in vaguely similar craft to mine. I also took time to chat with some of the owners of electric craft who were all very helpful and willing to show me around their boats to see the installation. This led to discussing my requirements with Rupert Latham of Norfolk who could supply components for me to install at my leisure.

Rupert proposed an SEM motor of 6 Kw at 72 volts. Batteries were lead acid traction cells of 2 volts each, arranged in two banks beneath the wheelhouse floor where the old diesel engine was mounted. They have a capacity of around 440 Ah and weigh about one ton. Battery charger and controller came together with a neat dashboard with meters and joystick motor control. It all connected easily with the wire harness supplied by Rupert.

Once the new motor and ancillaries arrived I arranged to have the Perkins motor lifted out and the new one lowered into the boat. The SEM motor is quite heavy at around 75 kgs. and required a simple gantry arrangement to assist with final fitting.

At the same time I decided to completely strip out the wheel house floor which was in poor condition. I was then able to remove the two huge 50 gallon tanks that held water and fuel. With the old engine removed and a clear open space I could give the bilges a really good clean.

As the work proceeded, first trials loomed closer and hopes were high. Finally, with the floor complete but no furniture installed, my curiosity took command and my wife and I did a trial run. It is a peculiar feeling to slip the mooring without an engine throbbing within the boat and it was distinctly eerie how the boat silently moved forward when I moved the joystick control. A comfortable cruising speed of about 4 mph was achieved at 50 amps and a top speed of about 6 mph



Old diesel engine

required 100 amps. Reverse proved to be more than adequate to stop the boat.

Our first real cruise with the new propulsion was to the Traditional Boat Rally at Henley. Our mooring was at Taplow, Maidenhead and we were able to cruise up to Henley, participate in the numerous sail by parades and return to Taplow on one charge, cruising at 50 amps. On another occasion we did the same trip over two days cruising at 40 amps and returned to our mooring with only half a charge consumed. A full charge takes about 8 hours and costs around £1.20. But that is only part of the joys of electric boating. The peace and lack of fumes are priceless.

As far as I am concerned, the conversion has been a complete success and LPS is a much better boat. So much so that I have now had a 60 ft. steel barge/houseboat built to my design, powered by four Lynch motors driving twin screws, and LPS is now up for sale.

See the Classified section for further details of La Petite Souris.

Electric Boat Association



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La Petite Souris. 30' x 9' x 2'6". Built by James Taylor of Chertsey 1953 of mahogany. 4 berths. Centre enclosed wheelhouse. Very spacious galley and stern cockpit. Two bunks forward. Porta potti toilet with washbasin, hanging locker opposite. Dinette/berth and couch in wheelhouse. Laid teak deck. 6 kW electric propulsion provides clean quiet cruising for two days plus, on one charge. Extensive restoration carried out over past four years. Excellent condition. Reason for sale: upgrading. Asking price £25K. Lying at Taplow. See picture opposite. To view phone Chris Evans mobile, 07926 362938

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Members wanting to buy or sell electric boats, motors, fittings or associated equipment are invited to submit a 50-word entry direct to the Editor (Note: No agents or brokers). The information contained in members' private advertisements is provided by the advertiser and the Editor is unable to vouch for their accuracy. It is the responsibility of prospective purchasers to satisfy themselves as to the accuracy of the information given and of the condition of goods advertised.

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