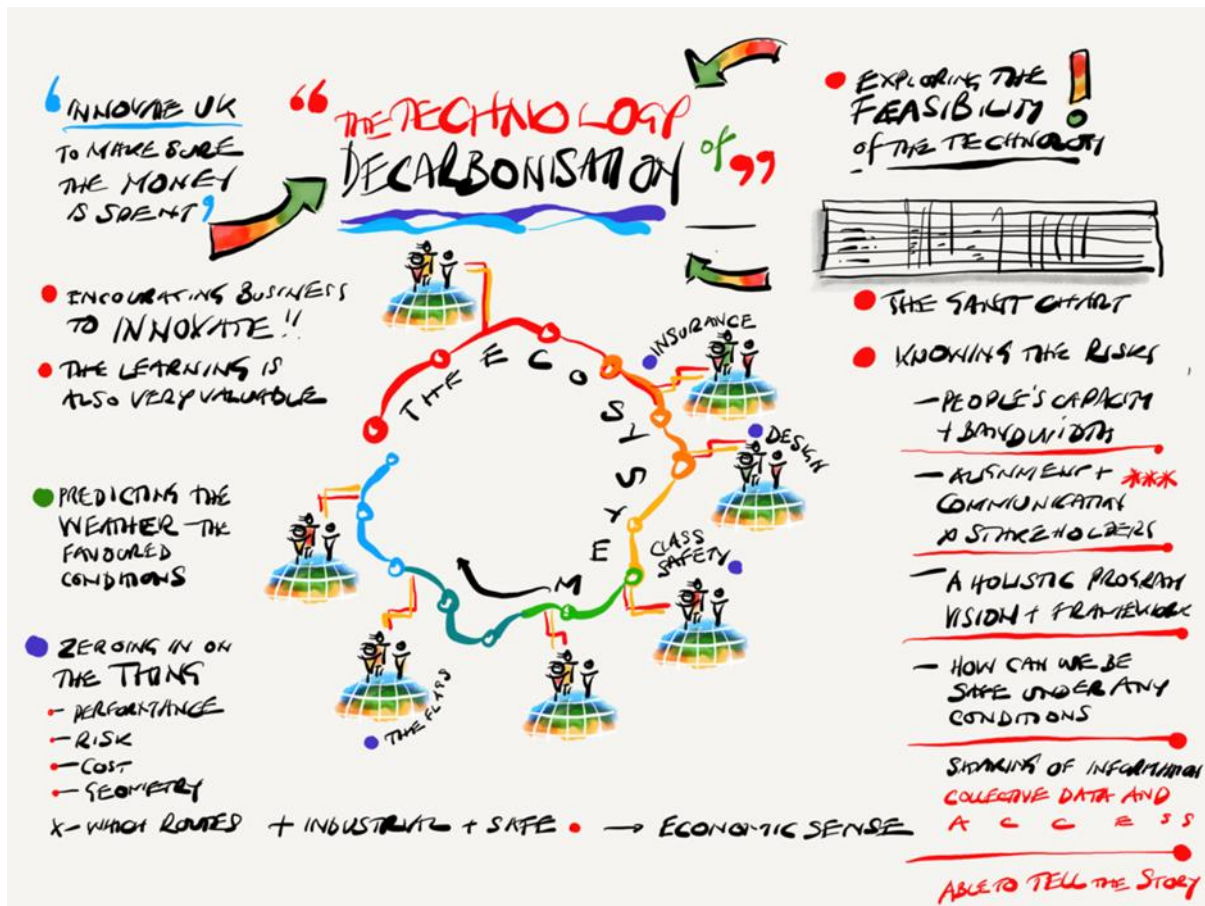




SHIPPING'S GREAT GLOBAL CHALLENGE



SUMMARY

STRAIGHTFORWARD BUSINESS PROPOSITION

Our work produced a compelling and straightforward Business Case – for a capital investment of £2.5m the Ultrabulk Tiger could save 20% fuel every year running the route from Baton Rouge to Liverpool carrying biomass for Drax. At current market prices the fuel-saving is worth about \$700,000 a year.

STRAIGHTFORWARD MANUFACTURING PROCESS

Making FastRigs from steel and aluminium optimises the balance between cost/weight/robustness, means the rigs are easily repaired and recycled at end of life – retaining material value within our system.

The aluminium wings are made up of four separate sections that lock together to be freestanding. They are mounted on deck with a straightforward steel rig heel.

Preparing the ship for fitting FastRigs is straightforward and can be co-ordinated with vessel being surveyed by Class Society.

‘NO-BRAINER’

From academics to financiers we are told “it’s a ‘no-brainer’”.

But the shipping industry appears to be stuck in a Catch 22 where nobody (so far) is prepared to finance the critical next stage – to put a Demonstrator in the water.

BROKEN MARKET – SENIOR DEBT

Project collaborators have solid reasons for not funding the Demonstrator – below. Between us, however, we agreed a that the right quality ship fitted with FastRigs could be chartered to Ultrabulk on a ‘bareboat’ basis to fulfil Drax’s contract.

EA Gibson, ship brokers, can identify suitable ships on our behalf.

Environmental Finance LLC have agreed, in principle, that they could provide leasing arrangements for the rigs. They need additional financial ‘headroom’ because the tech is unproven. This has been included in the ‘innovation’ cost analysis.

After attending a government-initiated ‘London International Shipping Week’ event on green financing for maritime we met with Marine Capital. They confirmed that banks will not allow their senior debt position on their assets to be subjugated by secondary financing of unproven technology.

We can’t prove it because we can’t finance it, and we can’t finance it because we can’t prove it.

Catch 22.

FIRST OF KIND CHALLENGE

It is well documented that few in shipping want to be first movers. This quote from a recent interview with BNPParibas articulates the issue well: *“We have some very successful clients that keep telling usThere is no first-mover advantages...You need the first 20 before the technology reaches the point where it can be used by everyone....So who is going to pay for that, except if you have subsidies?”*

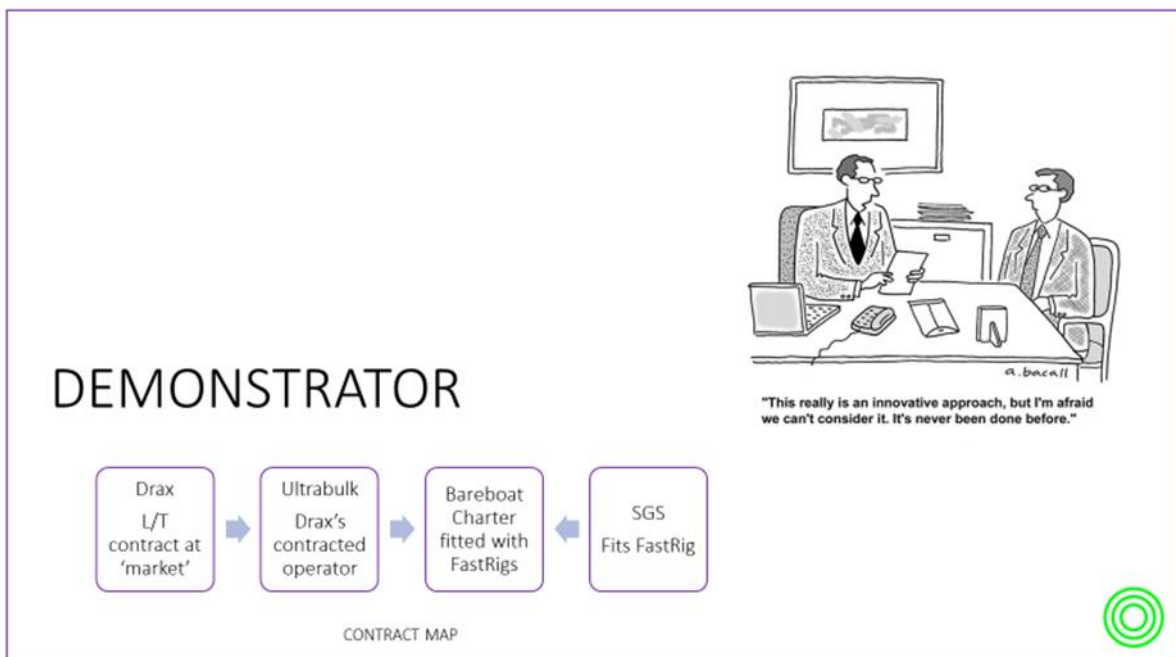
We have separated out the first-of-kind costs – developing the designs to be ready for installation, making the die for aluminium wings, developing the control systems etc – from the FastRig fabrication and fitting costs.

LEVEL PLAYING FIELD

By comparison the UK government’s public-private partnership Energy Technologies Institute funded the Finnish company Norsepower to the tune of [£3.5m](#). Recently that project demonstrated fuel savings of 8.2% for the Flettner rotor technology on a Maersk tanker working for Shell.

SGS is confident that it can at least double those fuel/GHG savings. SGS’s retractable design gives FastRig fitted ships access to a wider number of ports worldwide, and, being manufactured from recyclable, affordable materials, is more sustainable from a product lifecycle perspective. Furthermore, FastRigs do not need power from the engine to operate nor do SGS wingsails need to continue running - and using fuel to do so - whilst in port as a Flettner rotor does.

The shipping industry badly needs to see the Demonstration results from a wide number of technologies. Given the challenges, this kind of innovation support can only come from entrepreneurial governments. It would seem logical that the UK government should support UK initiatives so that the majority of the commercial benefits accrue in the UK.



A POSSIBLE SOLUTION

Working closely with EA Gibson and investment advisers IKIGAI Capital we propose the following broad structural arrangements to progress the project:

1. Separate out the 'innovation/first-of-kind' costs - £2m design development/testing plus 3 years management at £1m pa – and seek that element from govt/national investment bank/VCs who see the long-term wealth and jobs potential of the tech. This is an equity sell in SGS.
2. For the Demonstrator the cost of rigs (£2.5m / \$3.2m) plus installation cost (£0.5m / \$0.6m) - total cost \$4m - is paid for by the ship owner as a straightforward commercial sale. The Owner charters the ship out at market rate + \$700kpa - the value of the fuel savings. We bring Ultrabulk, the charterer, to the table so de-risk the deal for ship owner.
3. Ultrabulk are committed to shift all of Drax's biomass out of Baton Rouge, and have indicated willingness to do so on a FastRig fitted ship but are not able to invest. Ultrabulk - are predicted to make \$700kpa fuel save (if fuel cost remains static) per this Feasibility Study. Ultrabulk can use this predictable annual fuel save to hedge their forward bunker buying.
4. Drax gives the ship six year contract at market rate to anchor the whole deal. Dra may be able to monetise the GHG savings and can benefit from the corporate PR benefits of A. using renewables to move renewables; and B. pro-actively and ambitiously shifting a stubborn GHG emissions problem – the 'hard-to-abate' shipping sector.
5. SGS lease the FastRigs at \$700kpa to the owner, inclusive of an operation and maintenance contract. We have to stomach cost of finance + O&M cost so make ~\$200k pa on the Demo installation to incentivise the 'innovation investors'.

And, most critically, at this stage get the project away. There is more fuel-saving potential in the tech that we must unlock, and we the Demonstrator is a powerful sales platform to build order book

WIDER PROJECT IMPACT – delivering HOPE

This project gives people hope.

We demonstrate that we can, with a creative and determined approach, deploy our existing knowledge and technology to rapidly decarbonise so-called ‘hard-to-abate’ sectors. In a climate emergency hope is a critical driver.

At the project close Diane Gilpin was interviewed by US public broadcasters PRI on their ‘The World’ show. One listener went to the trouble of finding the SGS website and contacting us with the following message:

Coming home from my nursing job this evening I heard about Smart Green Shipping on the radio. The World, PRI.

*****The story and the vitalness of this project brought tears to my eyes!

As the parent/caregiver, with my husband, of our adult special needs son, I think that my reaction was one of HOPE.

Thanks for ALL of your hard work and efforts on behalf of our family and the worlds families.

And thanks too....for making me cry!

I shall be following along....

Peace to your hearts

Beyond what we do technically and commercially we give people hope. It doesn't finance steel structures; it doesn't figure on any balance sheet. It is, nonetheless, a valuable, regenerative output when we, as a species, face the greatest challenge we have experienced.

PROJECT TEAM

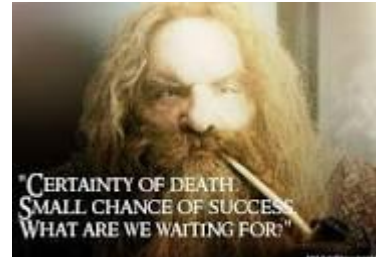
Project leader – Diane Gilpin: Designed project process, managed outcomes, led dissemination via media and presentations. Driving second stage financing for Demonstrator

Financial leader – Ian Haugh, FCCA: Managed all budgeting, finance and interface with IUK; interpreted fuel savings data; developed financial analyses for business case outcomes, building the long-term commercial Business Plan for SGS including IRR, ROI etc;

Project Manager – Frankie Haugh: Managed project communications, meeting minutes, updated website, dealt with incoming enquiries

Humphreys Yacht Design – quite simply the best naval architects in the world to work with. Determined, committed, intelligent, practical, functional and beautiful designs that are affordable, robust, and workmanlike whilst exuding elegance. HYD have supported the evolution of this initiative for a decade giving generously of their time and expertise.

It is time they were given the freedom to exercise their full creativity.



HYD's attitude over a decade of pioneering 21st Century wind ships

The Wolfson Unit for Maritime Technology and Industrial Aerodynamics – at the University of Southampton, provided detailed and reliable computational fluid dynamic data (cfd) analysis in eye-wateringly short lead times – a key advantage of working with yacht racing experts is they work fast and accurately, critical in developing designs at the speed we need to in order to decarbonise the global fleet; WUMTIA continue to support SGS in developing fuel savings analysis tools to drive future sales.

AES - are a marine design mechanical engineering company, based in New Zealand who specialise in design of sailing yacht masts, spars, rigging, associated rigging load estimation, computer modelling and loadings on deck. AES have been on the winning team in the America's Cup multiple times. This racing mindset ensured that this project benefited from best-in-class engineering support.

Graeme Winn – an America's Cup weather-router, Umpire and mathematician applied his considerable talents to evaluating the reams of data generated from the cfd processes on the hull/rig performance, combined with 40 data weather sets to replicate the ship operating at different dates in every season, and applied his proprietary routing algorithm to enable us to predict the total annual savings from the FastRigs for this ship and route.

Capital Law – SGS's commercial legal advisers drew up formal collaboration and IP agreements between HYD and SGS and helped shape our IP Strategy, advising on a roadmap for protecting our intellectual assets across the short, medium and long term.

Abel&Imray – patent attorneys processed the formal Design Registration for FastRig to protect the work undertaken in this project; they contributed to the development of the longer-term IP Strategy.

PROJECT COLLABORATORS – who they were, what they did



SOME OF THE TEAM TACKLING SHIPPING'S GREAT GLOBAL CHALLENGE

IMechE – sponsored the project making a significant financial contribution, provided vital engineering support and hosted project meetings.

UKI2S – seed investors in Smart Green Shipping Ltd; advisors on funding and fund-raising.

Drax – offer a long-term contract of affreightment to Ultrabulk if we can make the business case; provided PR support and lobbied on SGS behalf in Westminster with the aim of securing long term financial support to drive a zero-emission by 2030 project; provided critical data on necessary operational speeds, flow etc for cargo and - best of all – shared knowledge and experience from having already achieved the inspirational transformation away from coal to biomass.

Ultrabulk – provided critical operational and financial information; gave vital insights in to the day-to-day running of shipping business. Before this project had officially started Ultrabulk hosted us on the Ultra Tiger in Liverpool allowing the SGS team to understand all the essential operations on board, to take measurements, to learn about loading and discharge arrangements, to meet the master and crew. This background shaped the Design Brief and helped us to create a robust, workmanlike, best-in-class solution.

LR – oversaw project process; developed the HAZID process for use in next stage to help ensure compliance; shared critical market knowledge on when and how ships could be prepared for installations of FastRigs.



smart green shipping

Peter Hinchliffe OBE – key member of SGS Advisory Board, former Sec Gen International Chamber of Shipping with deep knowledge and understanding of shipping industry has provided invaluable support, refining communications, connecting SGS to market actors and bringing huge credibility to the initiative.

WTW – global risk assessors support SGS through the development of potential ‘parametric’ insurance products to give the market confidence to invest in the technology – insuring against the wind not blowing for example; they also ensure the FastRig tech will be insurable at Demonstrator stage and provided valuable introductions to potential investors and financiers particularly Environmental Finance

Group Partners – world class strategic advisors to global brands; application of Structured Visual Thinking methods of strategic development; introductions to ‘high net worth’ individuals with a view to securing next stage finance from impact investors.

Ned Molloy – a consultant to energy and shipping markets focusing on environmental opportunities and challenges. He has advised this project as a collaborator on a wide range of issues from public relations to potential hedging solutions based on the fuel savings from FastRigs.

BlueGreen Marketing – a shipping communications agency who supported the project by editing and developing stories ensuring a wide range of shipping and general media took them up.

International Futures Forum – work with governments, communities, businesses, foundations and others, supporting people experiencing the combination of aspiration for something better and frustration that little they do seems to get them nearer their goal. IFF help SGS develop capacity for inspiring and transformative innovation, particularly in Scotland.

EA Gibson – shipbrokers, have recently come on board and provided access to the market for arranging ship charter of suitable quality to be re-fitted with FastRigs as the Drax/Ultrabulk Demonstrator.



smart green shipping alliance



KEY PROJECT DELIVERABLES

1. Initial design of 'minimal viable product' iteration of FastRigs. With next stage funding there is more fuel saving potential to be achieved.
2. Design Registration in UK and Europe
3. Commercial agreements in place between HYD/SGSA to progress SGS with ownership of IP formalised.
4. Detailed fuel saving analysis; for this ship/route and as the template for a fuel saving analysis product – project name TradeWind
5. £40k product development funding via European Space Agency business incubation unit to progress TradeWind
6. Business Case for FastRigs – fuel savings/manufacturing costs/cost of additional steel on ships/payback
7. Investor Pack – short project intro 'teaser'; SGS Business plan with financials/IRR for A. launching and operating Demonstrator; B. FastRig product roll-out and; C. 2030 vision for zero emission technically, commercially viable FastShip – 100% renewable (wind + hydrogen/ammonia/biogas); pitch deck; Commercial agreements; IP roadmap; competitor analysis; risk analysis
8. Potential investor database
9. Corporate re-brand – dropping 'alliance' from logo to give more 'commercial' feel.
10. Website refresh

PROJECT WORK PLAN & BUDGET -SUMMARY

The project was delivered within the total budget of £100k.

All monitoring procedures were adhered to and scored well at each quarterly review. Our project Monitoring Officer was a pleasure to work with.

The project was organised in to 4 different Work Packages (WP). The first was project management, WP2 was the technical processes, WP3 was Business Case development and WP4 our Exploitation Strategy.

THINGS THAT DIDN'T GO TO PLAN

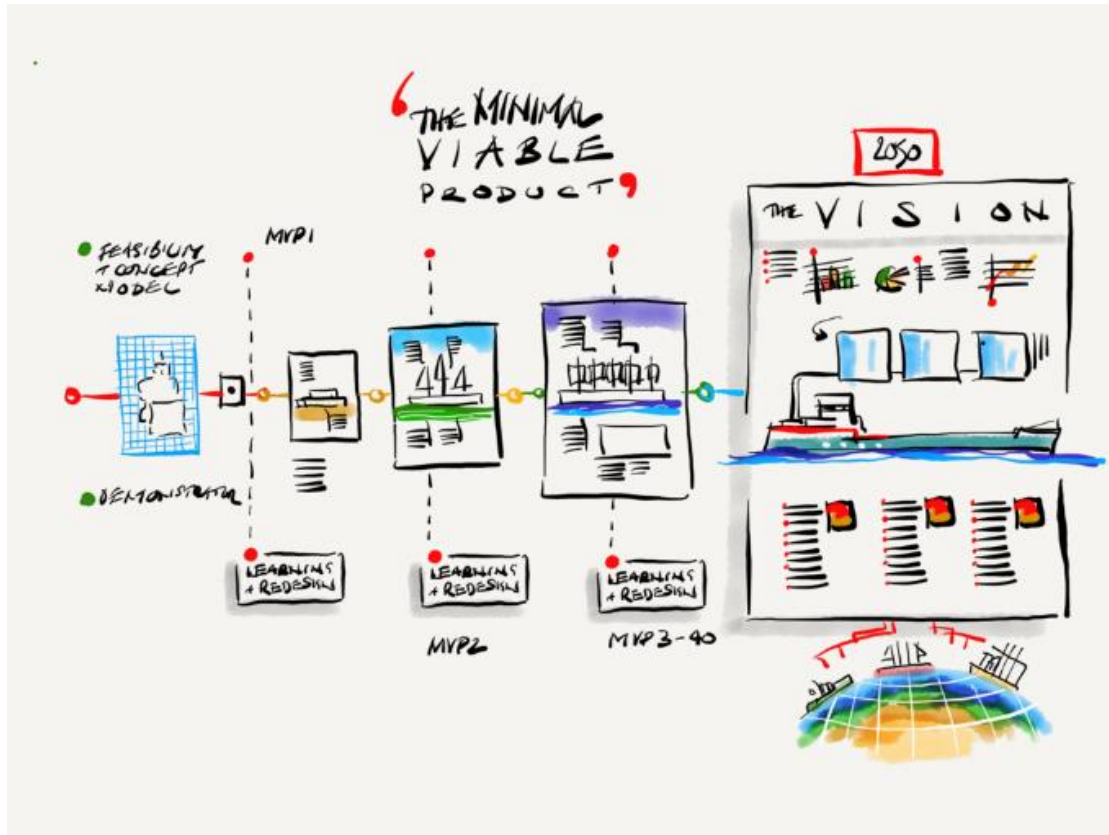
A deliverable identified at the outset was to find a second-hand Kamsarmax ship to use as a Demonstrator. It became clear in Q1 that this strategy would not be workable because of market conditions. So, we worked with the Ultrabulk Tiger as our 'template' ship.

We shifted the engineering analysis from AES to follow the intensive cfd work from WUMTIA. Originally, we'd planned to do it the other way but the project agreement at the Kick-off meeting to work to a 'minimal viable product' led to us changing the order of work.

We had planned to work with Cammell Laird on rig fabrication and fitting costs but owing to CL's work load and the delay at our end in getting design drawings to them, because of the above alteration, this was not possible. We engaged with Ferguson Marine in Scotland but before they could provide a quote for us, they went in to administration.

PROJECT REVIEW – key outcomes by quarter

At the initial kick off meeting we collectively agreed, that given the limitations of the budget, we should scope the work to develop a minimal viable project.



This is the wording the collaborative agreed:

Critical Purpose of this Stage to **Create Minimal Viable Product (MVP) in the context of a long-term vision**

The optimum outcome for this Feasibility Study:

Make the Business Case (Return on Investment) for commercially viable MVP solution for specific route (Baton Rouge – Liverpool; to narrow variabilities) to enable next stage Demonstrator whilst learning to inform development of future iterations of the tech

The wider impacts will drive the evolution

+ changing mindsets

+ changing infrastructure

Leading to

Commercial security – cost effectively future-proofing shipping and supply chains

At the Q2 tech update meeting we advised that we had made a couple of project plan alterations, changed order of design/cfd/engineering to improve efficiency and reviewed and updated the Risk Register.

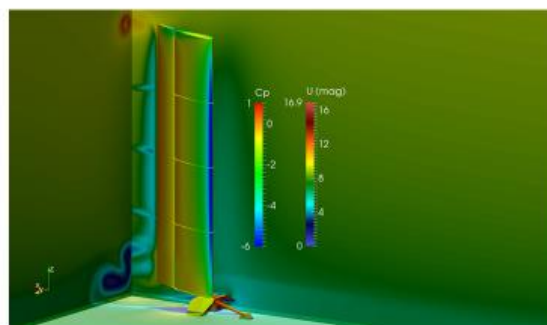
During Q2/3 we progressed FastRigs design. They are to be made from affordable, easily available, recyclable materials – steel and aluminium.

The component parts of the structure comprise:

- A steel rig heel fitting to attach the rig to the deck
- The FastRig lifts and retracts with 2 x simple hydraulic rams used for onboard cranes on geared ships
- The unique aluminium wing section is designed to be a monocoque structure – i.e. it is self-supporting
- It is manufactured via a proprietary extrusion from a die/mould. SGS will own the die/mould and this becomes part of the company's IP protection
- The wing comprises 4 x 10m sections – effectively they are stacked on top of one another to form the wing. This design keeps both cost and weight down
- This design also makes maintenance straightforward and cost effective as any damaged sections can be replaced quickly and affordably
- The rig is a rotating twin element wing configuration, to enhance efficiency and maximise the power that can be harnessed from a given wind speed and angle.
- The rig has actuators which move the main wing and flap automatically, to deliver the optimum trim setting for the wing for any wind speed and angle.
- The rig is controlled via an intelligent control system, developed from off-the-shelf yacht management systems which is straightforward to transfer to an industrial wing.

FASTRIGS: SAFE, EFFECTIVE, ROBUST

- Naval architecture from world leading yacht designers
- Workmanlike, cost-effective and robust construction from steel and aluminium
- Fully automated, retractable, safe
- Designed with input from ship owners, operators, crew, cargo owners, ports, insurers
- Overseen by Lloyds Register
- Institution of Mechanical Engineering support
- Marine engineers and MoD inputs
- Tested by Wolfson Unit, University of Southampton
- Fuel saving validated by America's Cup weather routers



FASTRIG MANUFACTURE COST ESTIMATES

The purpose, and funding, of this project allowed for high-level costing.

Within this project's budget it was not possible, nor efficient, to develop detailed manufacturing costs. At the next stage of design development, with proper budgets, we fully expect to develop the tech to harness better fuel savings. From this next design iteration, we will develop detailed production drawings against which manufacturers can provide formal detailed quotes.

We engaged with TP Group to provide inputs on cost of rig manufacture. At a meeting held at National Oceanography Centre SGS/HYD/IMECHE briefed them on rig design. Despite initial confidence that TPG would be able to provide high-level price indications for the potential manufacture of FastRigs at their facility in Manchester internal challenges prevented them from doing so. TP Group gave us an informal indication of cost of rig heel fitting of £50k each.

Consequently, SGS engaged directly with INAL, an SME in Manchester with experience of working in novel aluminium extrusions, to secure costs for the aluminium sections. INAL responded rapidly and enthusiastically. The estimate for the four wing sections is £100k per rig.

Additional to these costs is the hydraulic rams, the control systems and actuators.

Given that the none of this work is not, by design, especially challenging and that SGS is in discussions with several manufacturing facilities as potential project supporters/investors we are working with the high-level cost estimate of £400k per rig and a total FastRig budget of £2.5m. This includes a healthy contingency.

At the Q3 tech update - a Skype call - we delivered the BUSINESS CASE - 20% fuel savings/£2.5m/4-5year payback based on Ultrabulk fuel cost figures saving \$700k pa.

We went on to develop SGS's business structure, formalise agreements between HYD and SGS, develop our IP plan.

The final Quarter has been focused on securing funding for the next stage – the Demonstrator.

We formally registered the design to be protected in UK and Europe.

We agreed our strategic position on securing next stage financing:

Given the climate emergency and the apparent superior potential of our FastRigs solution **we will only seek to secure funding/investment of £8m/3 years to allow the whole project to progress at the necessary speed and intensity.**

SGS seeks an HQ where all the inter-connected elements of the SGS system – the technology hardware (Fast), the software systems (TradeWind) and the financial engineering (RE:Surge) can be co-located, and managed with the urgency and focus of an F1 team.

Whilst smaller tasks may be financed by smaller grants etc for, say, developing the rig control systems - the only real purpose for doing that is to keep the project alive. SGS's strategic decision, after consultation with key project advisors, partners and investors - is that this has project has to become tangible now, it has to happen as the first stage in wider a system change and so we must be ambitious, clear and focused on putting a Demonstrator in the water by 2021. We can't do that piecemeal. We will be ambitious, fully focused and courageous.

WHOLE PROJECT MEDIA COVERAGE

Thanks to our PR and comms people, working in-kind on this project, extensive media coverage, many presentations at events – both ‘green’ and shipping - in the UK and across EU were created throughout the project.

Our target was for one OpEd per quarter and one event/conference per quarter. We exceeded these targets in each quarter. A summary of the media coverage appears on our website:

<https://smartgreenshipping.com/press>

We have yet to update with two international news media:

<https://grist.org/article/dream-ships-could-turn-the-tide-for-trans-ocean-shipping/>

<https://www.pri.org/file/2019-10-28/how-solve-shipping-industrys-emissions-problem-sails>

The announcement of ESA support attracted a great deal of attention.

SGS presented at events such as Green Ship Technology, Copenhagen; All Energy, Glasgow; NorShipping, Oslo; International Futures Forum, Edinburgh; Safety4Sea, London; London International Shipping Week; The Royal Institute of Naval Architects.

Diane Gilpin sits on the DfT’s Clean Maritime Council and ensured that wind technologies were included in the Clean Maritime Plan. Frontier Economics calculated, on behalf of the UK government, that **the value to the UK economy of developing wind propulsion solutions for shipping is: £300m in the 2020s and £2100m in the 2050s.**

COMPETITOR ANALYSIS

In October 2019 Norsepower announced, along with Shell and Maersk, the results of their year-long Demonstrator project. We have summarised these developments and compared it with SGS's work progressed in this Feasibility Study.

	Flettner - Norsepower	Wingsail – FastRig SGS
UK Government funding	ETI £3.5m	IUK £70,000
nationality of investee	Finnish	British
Fuel save demonstrator	8.2%	n/a
Predicted fuel save pre Demo	7-10%	20+%
Materials (lifecycle impacts)	Composites, non recyclable	Steel/aluminium - recyclable
Rig costs	£2.3m ⁱ	£2.5m
Installation/ship prep cost	£0.4	£0.4
Retractable – usability in many ports	NO	YES
Energy needed to operate	YES	NO
Energy needed to operate in port	YES	NO




Norsepower Shell Demonstrator


At the recent Royal Institution of Naval Architects wind conference – where Diane Gilpin gave the Keynote address, and acted as Chair – all SGS competitors were in attendance. Of course, no one is revealing their hand fully, but we saw nothing threatening aside from the less effective projects that are better funded. Colleagues from WUMTIA at the event concurred with this conclusion.

NEXT STAGE FUNDING

FUNDING TO OVERCOME BARRIERS	
• First-of-kind	£2.0m
• Developing control system software	
• Aluminium wing mould	
• Design in circular economy – built to be adapted	
• Preparing the ship	£0.5m
• Additional deck steel	
• Loss of capacity and utilisation whilst refitting	
• Removal at end of pilot	
• Rig production cost	£2.5m
• 3 year design, build, test, manage programme	£3.0m
• People	
• Place	
TOTAL	£8.0m over 3 years



Why don't existing parties fund Demonstrator?	
• Drax	
• Shipping – not core business	
• Incentivises its supply chain via long term contracts/offtake agreements	
• Ultrabulk	
• Fear of being first mover (happy to be second)	
• Additional first-of-kind costs	
• Divesting assets in face of challenging market conditions	
• No ships available to retrofit	
• Bareboat Charterer – via EA Gibson shipbrokers	
• Doesn't benefit from fuel savings resulting from additional capital cost	
• Ship financed by banks who won't allow senior debt to be risked by installations of unproven technology	
*Both Drax and Ultrabulk are available for conversation with potential investors	



Even with Drax's commercial demand pull in place, that makes the next step commercially viable via a lease finance process, there are very challenging market obstacles. As described on Page 3 we have developed a next stage funding strategy where the commercial element of the project – fitting the Demonstrator - stands outside the innovation and management costs creating two elements of the project to be financed differently.

SCOTTISH GOVERNMENT

SGS is in discussions with the Scottish government who are keen to support Mission Challenges such as this one. They are brokering possible sites for an SGS HQ, making introductions to suitable manufacturing partners and bringing grant/public sector financing possibilities via their new investment bank and Scottish Enterprise.

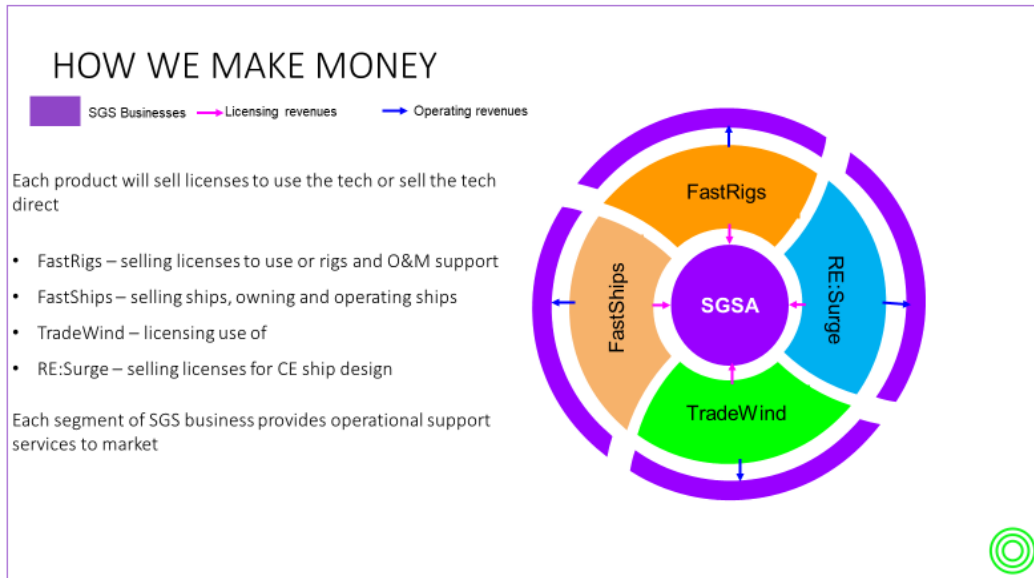
The next step is a meeting in December 2019, hosted by the Scottish government, to pull together the agreements-in-principle to get the Demonstrator in the water by 2021 and to have a full-size FastRig available to Demonstrate at CoP 26 to be held in Glasgow in Nov 2020.

This will be discussed at this project's close-out meeting on Nov 13 at IMechE.

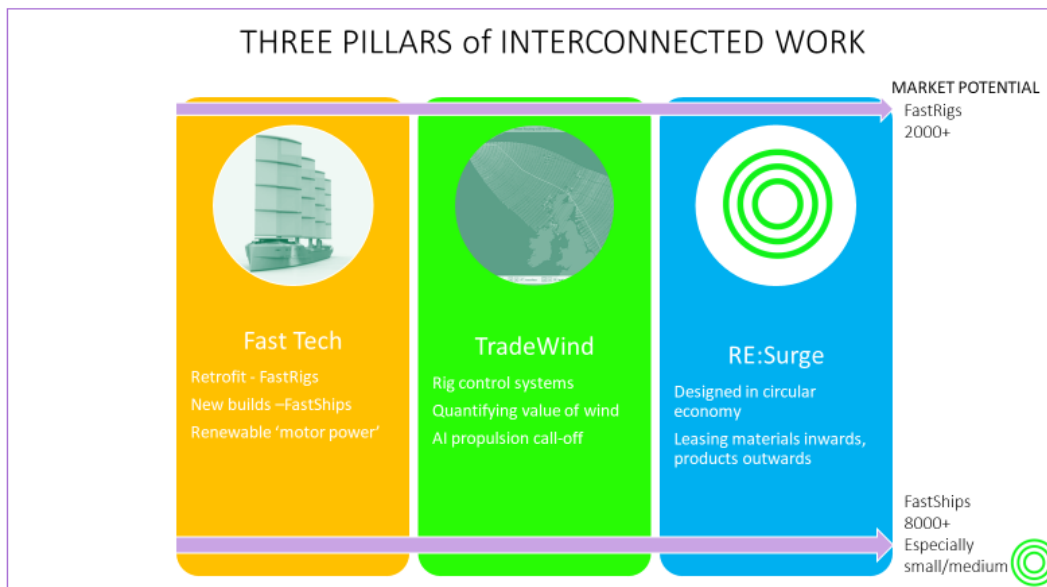
SGSA The Business

In Q4 we have focused on taking the SGS business to market: how we generate revenues, how we organise ourselves, how we build our team.

OUR BUSINESS STRUCTURE




ORGANISING OUR WORK PROGRAMMES



PROTECTING OUR INTELLECTUAL ASSETS

Working with Capital Law we ‘workshopped’ the various intellectual assets and developed a strategy for protection as the business develops over time.

Asset	Protection	Ownership
FastRigs design	Patents/Registered Design/confidentiality/non-compete/copyright/trademark/branding	SGSA/HYD
FastRig manufacture	Registered Design/contractual ownership of rig manufacturing die/confidentiality/non-compete	SGSA
FastShip concept design	Registered Design/contractual ownership of rig manufacturing die/trademark/confidentiality/non-compete	SGSA
FastShip manufacture	Patents/manufacturing systems/ownership of die	SGSA
TradeWind	Patents/copyright (background) on code/exclusive license for use of existing algorithm Code library/Trademarks/branding	Graeme Winn(GW) SGSA
RE:Surge	Confidentiality/non-compete/branding/trademark	SGSA

Capital Law SGSA IP Map developed with Capital Law 

IDENTIFYING and MANAGING RISK

The project team maintained a dynamic Risk Register throughout the project. Identification of key risks enables adept management to mitigate those risks

Managing Risk

Risk Number	Type of Risk	Risk Description (If...)	Potential Impact (Then...)	Probability (H/M/L)	Impact (H/M/L)				Mitigation
					Specification	Time	Cost	Business Case Impact	
1	Technical	loss of key designers	project delayed, design compromised	L	H	H	H	H	work with design house (not individual), key man insurance
2	Technical	FastRig control systems fail	Rigs don't deliver fuel savings	L	M	L	H	M	Build full-size test rig on land - test mfg. control system. Use tested rig as one of Demo ships rigs
3	Technical	Safety of vessel is compromised	Danger to crew/environment	L	L	L	L	L	All work being undertaken with class, ensuring all safety specifications meter exceeded
4	Technical	Rig Manufacturing process failure	Can't deliver rigs in time	M	M	M	H	H	1. Excellent PM, 2. established team from Feasibility Study - good working relationships; 3. All components are proven - we combine in novel way
5	Technical	Fitting rig to ship is unsuccessful	Project delayed	L	H	H	H	H	1. Work with Marine engineers, class to develop, test robust process; 2. send agent to yard to oversee first installations
6	Commercial	Failure to find ship to retrofit	Market obstacles around split incentive/senior debt make this the most challenging aspect of the project. Resulting in severe delays	H	H	H	H	H	1. Financial 'headroom' to smooth 'unproven tech' risk; 2. work with EA Gibson brokers to find suitable (blue chip) ship, available at the right time at the right yard to be retrofitted; 3. work from project outset to shore up collaboration to commit to agreeing on ship; 4. Develop contingency projects in case Drax/Ultrabulk falls away
7	Commercial	Competitors get to market first	Low hanging fruit secured by others	H	L	L	L	L	1. Competitors 'homalise' the tech; 2. SG6 is a system solution, we are in a long game to build 100% renewable ships; 3. 60000 ships in global fleet - plenty of room for all; 4. Competition triggers an 'arms race' to drive market
8	Commercial	Fear of being first mover	Can't deliver project on time	M	H	H	H	H	1. First mover is major market barrier that SG6 has addressed in Feasibility stage, it has taken responsibility to find bare-boat charter and co-ord all legal actors; 2. Collaboration gives confidence; 3. Key project obstacle that funding overcomes - covers fmk costs, gives finance 'headroom' for 'unproven' tech
9	Technical	Poor project management	Project undeliverable	M	H	H	H	H	Best PMs hired (from racing so familiar with deadlines); ensure planning realistic; stop/go to mitigate exposure to investors £
10	Commercial	we can't agree contracts for Demo ship	Project undeliverable	M	H	H	H	H	All Feasibility Study collaborations have agreed in prin in writing to work together if 'Innovation funding' is secured
11	Technical	Insufficient data comes of Demo ship	Delays FastRig design development, reduces market confidence in fuel savings	L	M	M	M	M	Market gets tech comfort from Demo; first sailings will have SG6 rep on board to monitor data systems and FastRig controls

RETURNS

We have changed the trading name to SGS to be more recognisable as a commercial entity. Our website, and email has been updated to reflect this.

We have developed clear investor proposition for £5m equity funding into the project. (The remaining £3m will be secured via a commercial transaction for retrofitting FastRigs per the proposal on page 3). It makes significant financial returns and wider returns on investment.

BIG PICTURE RETURNS and OUTCOMES

- SGS generates revenues by 2023
- 2 for 1: By overcoming one innovation obstacle via commercial Demonstrator we accelerate two manufacturing opportunities - FastRigs and Fast Ships
- By 2035 the capital value of installed Fast technologies £3.9bn
- In 2035 pre-tax profits £74m, by 2035 accumulated pre-tax profits £300m
- IRR of the total business cash flow 21% (by 2030) and 37% (2035)
- Accumulated fossil fuel savings 2035 - 5m tonnes, 15m tonnes CO₂
- Other related 'multiplier' opportunities that may emerge:
 - Maritime AI systems design – for other (non-wind) propulsion systems
 - Maritime GHG measuring via satellite observation – underpinning green finance/carbon pricing arrangements
 - CE manufacturing systems design – export process licensing
- Green jobs – design, ship manufacturing, operation and maintenance, standards, digital, finance



OTHER INVESTMENT OPPORTUNITIES

There is interest in investing from a second UK site, but this is further away from conclusion.

The EU is launching an Innovation Fund focused on shipping in the circular economy focused on driving new, high value technical approaches to shipping. This is being explored with Europe's leading ship building body – Sea Europe, European politicians and EC civil servants at the end of November 2019. Diane Gilpin is moderating that event.

IKIGAI is our current preferred investment adviser. They are renewable energy specialists with a global network of early-stage investors. We are working together to refine our investment pitch with them.

We are also in conversations with high net worth individuals inspired by the project via our network.

Our preferred investment is directly into the technology, but because we need to explore every avenue to get the Demonstrator launched, but we have also been discussing the potential of offsetting aviation emissions via SGS technologies. The aviation industry struggles to find GHG reduction solutions in sector but it is, nevertheless, committed to reach net zero emission in the [UK by 2020 and globally by 2050](#). It can only achieve this through marginally efficiency gains and GHG offsets. The concept is that if aviation invests in SGS's technology it could claim all the GHG emission reductions our technologies deliver against its emission targets.

We are also exploring in-sector emission trading scheme is with large ship owner/operators in the mining sector along similar lines.

CONCLUSION

This project has been well executed and produced excellent results. We have delivered against all of our targets, stayed within budget and progressed the project.

We are proud of our achievements within the limited budgets.

However, now more than ever, with many governments and local authorities declaring a climate emergency, it is time to take bold action.

Smart Green Shipping commits to do that to ensure the potential of this project is fully explored and can be accelerated for economic and environmental gain.

ⁱ <https://glomeep.imo.org/technology/flettner-rotors/>