



MANUFACTURING BROCHURE
SUB-CONTRACT

ABOUT US

Established in 2000 in Colchester, Essex by former Lotus engineer Simon Farren, Reverie started by designing and producing niche track day and aftermarket Carbon Fibre performance parts, primarily for Lotus models.

Growing quickly, in 2001 Reverie started offering composite engineering and manufacturing services to small car manufacturers. Caterham Cars commissioned Reverie to design and manufacture a complete induction silencer system for their R500 with K-Series engine. Between 2003 and 2005, Reverie was proudly involved in winning a large motorsport composite project for Foggy PETRONAS Racing, involving the manufacture of 150 full panel sets for the FP1 homologation special motorbike. All delivery times and quality targets were met for both the OEM manufacturing company and the FP1 race team. More recently, after gaining ISO9001:2015 certification, Reverie was tier 1 selected to manufacture Carbon Fibre OEM key fobs for McLaren (MP4/12 P1) to very high clear coated paint specifications. This large contract involved manufacturing over 24,000 units.

WHY CHOOSE REVERIE?

An established market leader with passionate, professional and highly skilled staff who offer expertise in a variety of fields including design & manufacture, automotive, motorsport, telecoms, marine, military, leisure and other composite products. Reverie will work with you to achieve world leading products that we are all proud of. Reverie supply LMP1/WRC Motorsport, not F1, which means we are not seasonal and will therefore not increase or inflate our prices or interrupt your supply.

WHY THE AUTOCLAVED PROCESS?

We predominantly use pre-impregnated epoxy thermoset composite materials to ensure that high fibre contents can be achieved consistently. We also vacuum bag and autoclave nearly all components to further ensure low void contents and trapped volatiles to maximise interlaminar shear properties by forcing the various layers in the fibre/resin matrix together. This process results in high quality lightweight parts achievable time and time again, with low void content and surface pin-holing.

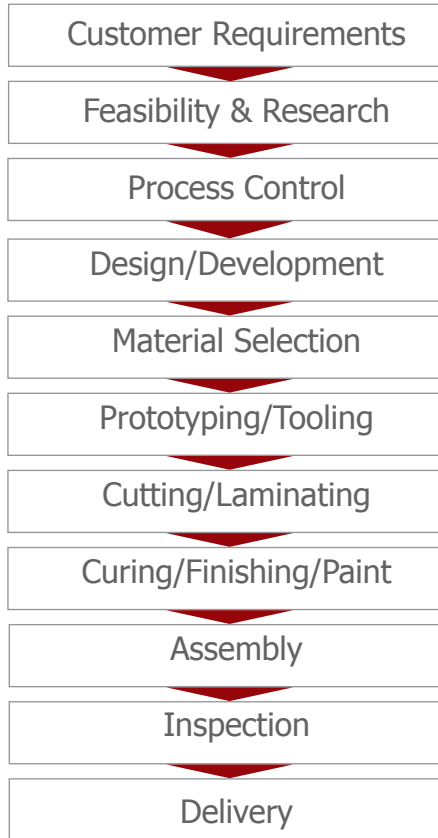


MD, Simon J. Farren



» OUR PROCESS

We split our manufacturing process into key steps:



» CUSTOMER REQUIREMENTS

Information is key and at the start of any project we will take you, the client, through the necessary processes step by step and openly discuss your project with you including operating conditions, quality requirements, tolerances and appropriate specifications.

Initially, we need to establish where the project is at (whether it is just an idea which needs to be designed and developed, or a fully developed part ready for manufacture). At this stage, we ask for 3D CAD models (IGES/STEP), 2D DWG/PDF, any physical models, forecasted production volumes and all relevant documents in order for us to provide an accurate quote and advise on the best manufacturing route forwards.

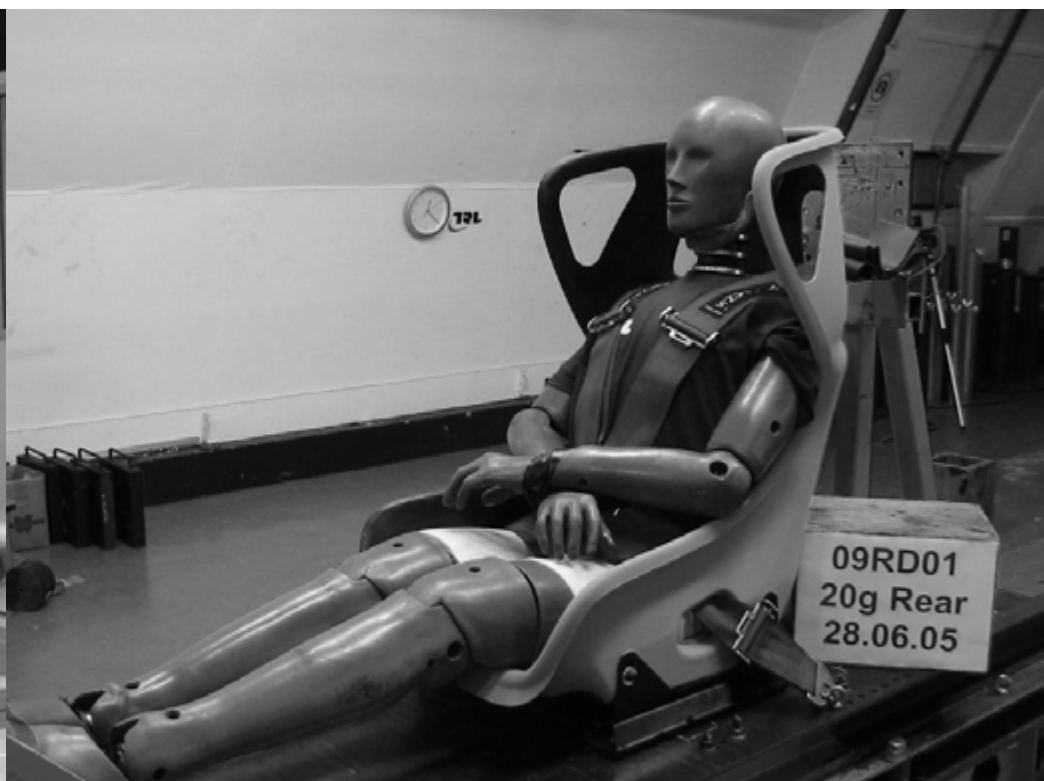
For physical models, we can use our FARO arm or 3D scanner to digitize models into CAD software that accurately captures the original form and allows us to study the part for manufacturing and tooling feasibility.

» FEASIBILITY & RESEARCH

Depending on the complexity of the project or part, additional feasibility and research studies may need to be undertaken in order to ensure successful production and repeatability including FMEA stress analysis, CFD, researching new materials and processes or ways of tooling as needed.

» PROCESS CONTROL

All new project components have parent/child part numbers, routings, resources, labour skill types/levels, BOMs assigned and CAD files attached. This ensures full traceability and production capacity planning can be carried out using data capturing MRP/ERP software. We have dedicated process control flow charts, works instructions and procedures all meeting ISO9001:2015.



» DESIGN/ DEVELOPMENT

You may already have a designed part and associated CAD files that require manufacturing, however we also offer a full design and development service if there is only a physical model to go from.

Utilizing the latest CAD packages, including SolidWorks and Hypermill/HyperCAD, allows us to undertake surface and solid modelling and we can also supply visual renders if required. All files are issue controlled and stored in a secure PDM vault.

We are able to reverse engineer components to tight tolerances verified by our FARO Fusion arm which can take an unlimited number of precise measurement points.

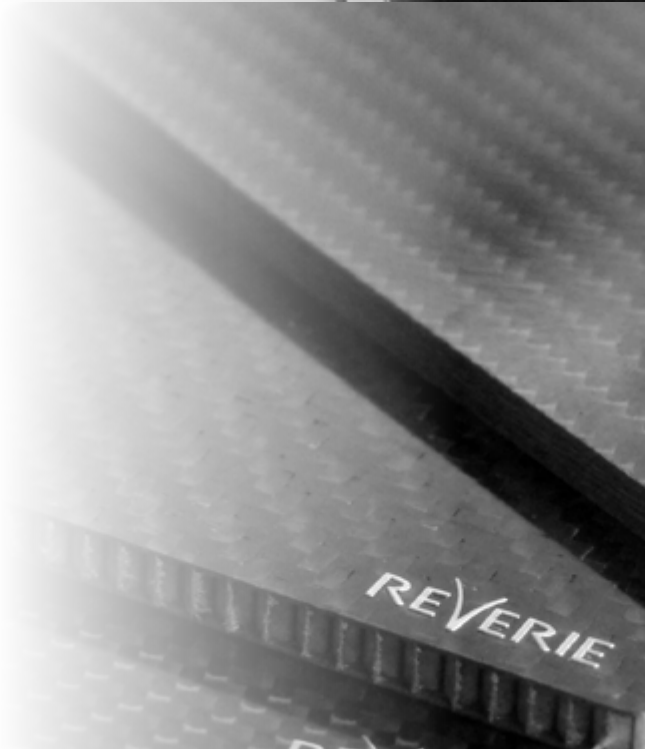
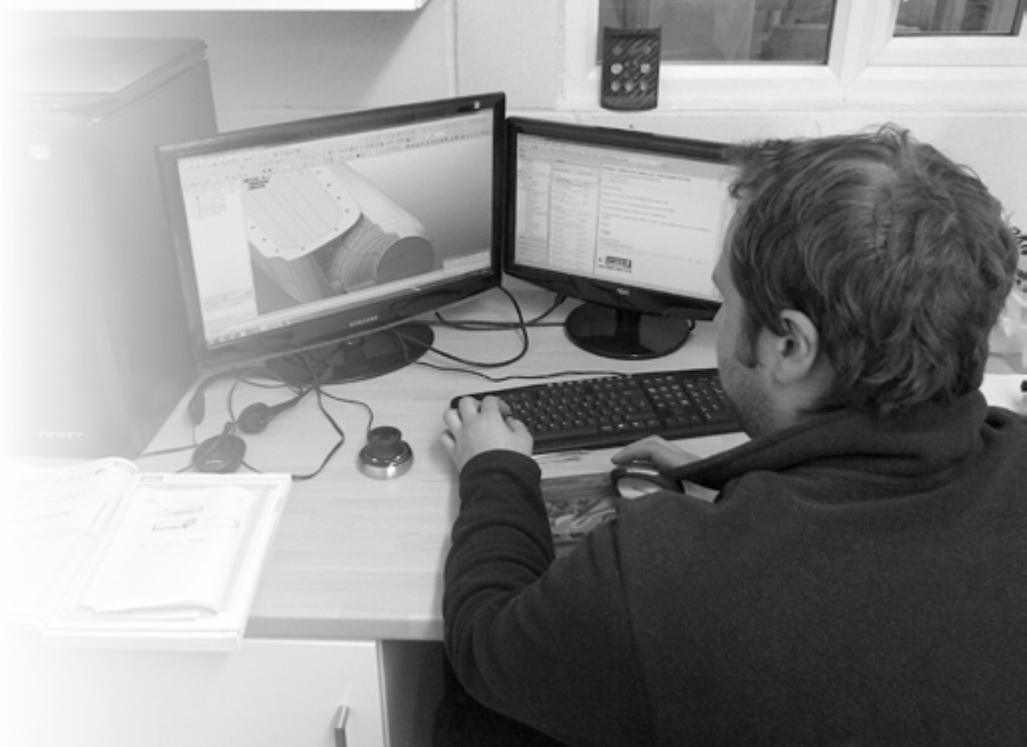
If needed, we also have a 3D scanner that allows us to capture and import complex surfaces into computer models.

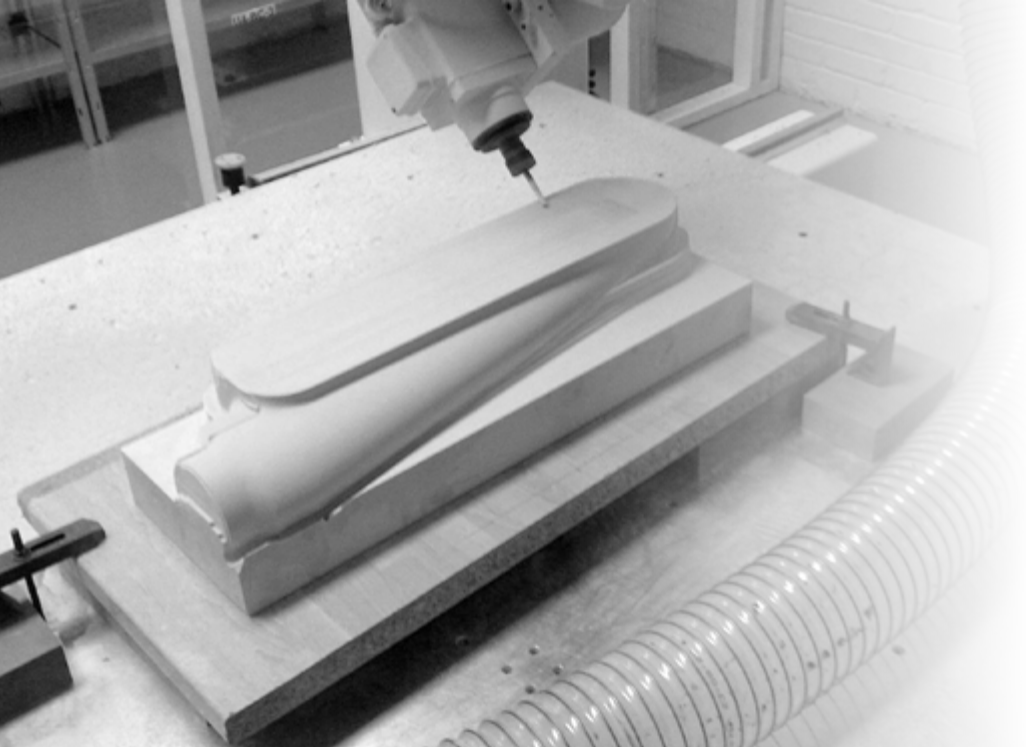
MATERIAL SELECTION

Materials are selected based on cost, quality, operating parameters, structural requirements (toughness/strength), durability, fire retardancy and availability. After material selection, full production control laminate and trim drawings are produced.

PROTOTYPING

If a proof of concept is needed, we can 3D print prototypes in ABS or standard PLA filament. Alternatively, we can use bureau services for SLS/SLA models which allows testing for functionality, saving considerable time and money if the design needs tweaking. We can also make a low cost epoxy CNC tool and produce a composite component for one-off samples.

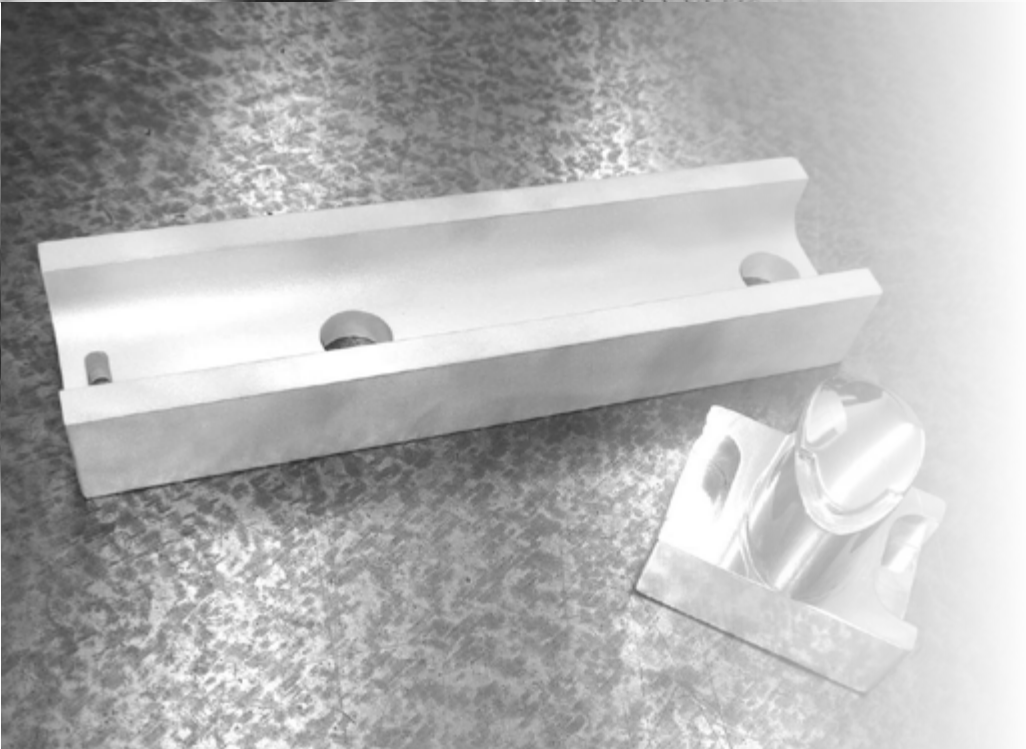




» TOOLING, JIGS MANUFACTURE

Design of the tooling occurs hand in hand with the design of the part (if we are involved in the part design process) and is discussed with you right from the start or we can design tooling to suit your part files.

The material selected for tooling depends on a number of different factors including expected part quantities (one-off, batch or full-scale production), part complexity and curing requirements.



For low volume production, CNC machined epoxy tooling block is often suitable however for medium to large production quantities we can also CNC machine tooling from aluminium or produce autoclaved composite tooling from male epoxy CNC patterns.

Our tooling is designed using SolidWorks and HyperCAD/MILL allowing us to run draft analysis and provide tool manufacture run times.

We also apply the correct expansion scaling factor to allow for cure temperatures. Steel drill bushes are used where needed in tools or drill jigs to improve accuracy and life of the tool.



Patterns and tools are machined on site with our accurate HAAS VF4 3+1 axis (with on-machine measurement probing) or our Thermwood M67-55 5-axis router.

All tools/jigs we create are logged and labelled on our MRP system for complete traceability and are linked to works order BOMs to ensure a smooth manufacturing process.

- » CUTTING
- » LAMINATING
- » CURING

Once the parts are fully designed, signed off by you and the tooling has been manufactured, the project is ready to go into a first-of part sample before full production.

PRE-PREG CUTTING & KITTING

Using sophisticated SigmaNEST nesting software and 2 x CNC tables allows us to maintain consistent repeatability, minimize wastage, accurately control fibre direction and enable conformance to drawings.

PRE-PREG LAMINATION

We have an 880Sq ft clean room where plies from the CNC cut kit are hand-layed into the moulds by our skilled technicians.

Plies and vacuum bagging are stringently cross checked by another employee of the same or higher skill level to ensure the production process runs smoothly and any mistakes are rectified before cure.

Barcoded traceability part stickers are laminated and cured into the components.

AUTOCLAVED MOULDING

Our factory contains two autoclaves of different sizes, having the advantage of allowing the optimum size of autoclave to be chosen for a particular job, ensuring the best quality part and the most economical cost to you, the client.

Autoclave curing the thermoset pre-pregs takes place at up to 100psi to give the best Fibre volume fraction and lowest void content.





- » TRIMMING
- » PAINTING
- » FINISHING

RESIN INFUSION MOULDING (RIM)

As well as autoclave moulding, we can also offer resin infusion moulding which is suitable for larger parts using dry fabrics and vacuum infused epoxy resin to achieve lower costs without potential thermal expansion or distortion issues.



TRIMMING

Once parts have been cured and released from the moulds, they are then sent to our dedicated trimming rooms. Our experienced trimmers remove any excess material and resin flash to EOP scribe lines using jigs and fixtures to prepare the part for final fitting or painting.

Inserts, fasteners and other items are assembled to the moulding to complete the part. This will then be finished as required, either highly polished or rubbed down to a matte surface ready for painting.



PAINTING/POLISHING

Parts are prepared for painting by abrasive sanding or vapour blasting and then painted in our large spray booth (L4500mm x W3500mm x H2400mm) allowing us to be able to finish parts to high specification, coloured or clear coated using a wide range of paints and state of the art paint guns.

We are able to meet very demanding levels of surface finish and peel and only use the highest quality polishing consumables to meet or exceed your specifications.

» INSPECTION

» QUALITY CONTROL

We are equipped to provide complete inspections of finished parts to the required standards and specifications and provide simple or detailed 'FAIR' reports against client 3D CAD.

For inspection, we have a dedicated 1500 Lux inspection area with surface table, including FARO Fusion arm + CAM 2.0 software (able to measure tolerances down to 0.036mm/0.0014"), full 3D scanner and Baty R14 shadow graph machine.

QUALITY CONTROL

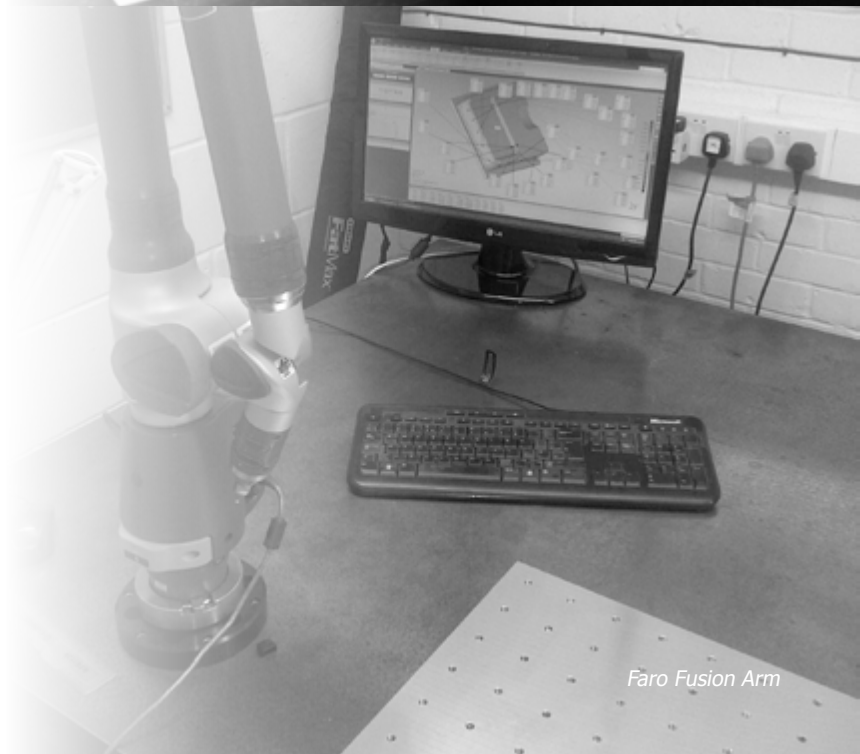
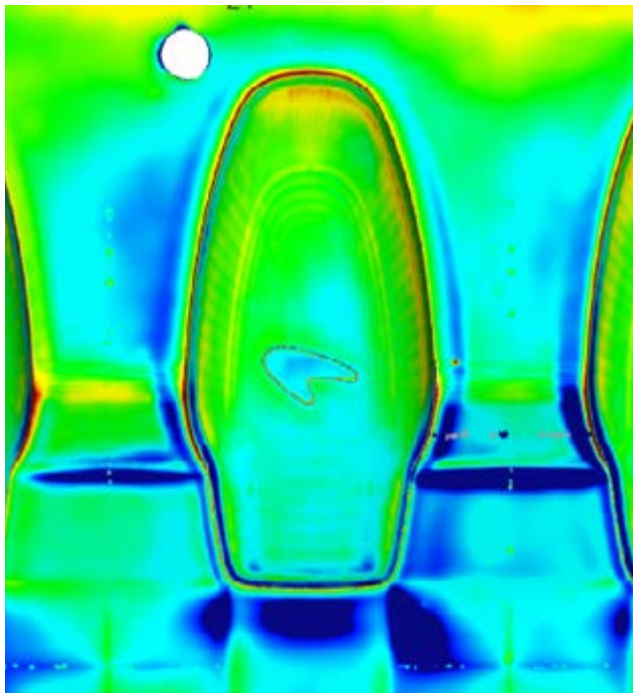
In 2015 we gained ISO9001:2015 certification via our quality management principles, production process and strong customer focus.

We use 123insight.net MRP/ERP software which ensures complete bar-coded traceability of every step of the manufacturing process, from initial design through to final delivery. We use visual planning software to ensure smooth production process and on-time delivery. All our files and product documents are logged with issue numbers in a secure PDM vault for complete security and backed up regularly.



DELIVERY

Once the part(s) have completed the inspection process, they are ready for shipping. As with our own product line, we are able to ship worldwide at competitive rates. Shipping times are project specific, however we dispatch on time and keep you informed with all tracking details.



Faro Fusion Arm



» EQUIPMENT » FACILITIES

In our 10,550sq/ft factory we have a range of facilities including;

- » Bonding room with 2.4m x 1.5m surface table
- » Temperature controlled clean room (880 sq/ft)
- » Freezers (for -18°C storage of pre-pregs)
- » 3 x ovens
- » Dedicated pattern development area inc. 2.4m x 4.6m steel datum floor area
- » Fully extracted trim room
- » Fully equipped inspection room with surface table

EQUIPMENT:

- » 2 x autoclaves:
(1150mm Ø x L3750mm x Z800mm ~ 100psi, 230°C)
(480mm Ø x L750mm x Z380mm ~ 110psi, 300°C)
- » 2 x CNC pre-preg cutting tables:
(Large: 3500mm x 2265mm)
(Small: 2650mm x 2265mm)
- » Upbox 3D printer
(max. print size: 255 x 205 x 205mm)
- » Full CAD capabilities including SolidWorks 2017 (inc. FMEA), Hypermill/HyperCAD, Spaceclaim
- » 4 ton 2 post vehicle lift

INSPECTION EQUIPMENT:

- » BATY R14 Shadow Graph with DXF import/export
- » FARO Fusion inspection arm + CAM 2.0 inspection software
- » 3D white light scanner

NOTE: Full inspection/FAIR reports and certificates of conformance can be produced for each part or samples from batches if required.

MACHINING CAPABILITIES:

- » M67-55 Thermwood 5-Axis CNC router, max. working size: 1524mm x 1524mm x 914mm
- » VF4 3+1 Axis HAAS with Reinsure OMP40 Probe, max. working size: 1270mm x 508mm x 635 mm

FINISHING CAPABILITIES:

- » Paint spray booth (L3.5m x W4.5m x H2.5m)
- » Paint vapour matt B1315 wet blaster
- » Polishing bays

» COMPOSITE REPAIR

Whilst Carbon Fibre is a tough material, it is not immune from damage. As such, we offer composite repairing services on almost any composite items, be it race/road cars, bikes, boats, yachts and more.

We can quote to offer you small autoclaved or oven cured pre-preg repairs to damaged areas, small or larger wet laminated repairs or simply stripping off and refinishing chipped, scratched, dented or peeling/lifting clear coats to restore cosmetics.

We have a 4 ton 2 post car lift for automotive repairs (or for fitting our own brand parts) and all repairs take place on our site in Colchester, Essex, UK.

AUTOMOTIVE REPAIRS

We can give estimates from photographs and full written fixed quotations on receipt of parts and inspection.

We have repaired and re-skinned parts for Audi R8s, Bugatti Veyrons, Ferraris, Lotus and Formula 1 to name a few. Customers return to us because we repair to the highest of cosmetic standards, on time and to the price quoted.

BIKE REPAIRS

We can repair most Carbon Fibre bikes, from minor cracks and blemishes to frame and wheel repairs. We pride ourselves on returning bikes back to pristine condition, ensuring your satisfaction and peace of mind.

MARINE REPAIRS

Carbon Fibre is being increasingly used in boats and yachts due to its strength, lightness, corrosion resistance and aesthetic properties however it can still be damaged necessitating repair. We have previously repaired catamaran masts, foils and spinnaker chutes and understand (and can cater for) the complexities and logistics of marine repair.

In addition to our repair service, we are able to provide modification to composite marine components. Previously, we have designed and manufactured dagger boards and compass brackets for marine applications.





» MARKET SECTORS

We cater for and have experience in a wide range of different market sectors, some of which include:

» **AUTOMOTIVE**

As well as our own product range manufacturing bespoke items for Lotus cars and other automotive applications, we are also able to provide sub-contract design and manufacturing capabilities to automotive OEM, tier 1 and tier 2 manufacturers too.

» **DEFENCE**

Opportunities to use composite materials to reduce weight or improve ballistics protection over conventional materials.

» **Hi-Fi**

Composites provide rigidity and lightness for speaker drive cones, turntable plinths and wall brackets.

» **FURNITURE/LIFESTYLE**

We have been involved in manufacturing high-end luxury furnishings for design companies such as Jules Sturges design who require exacting standards and finishes.

» **MARINE**

Manufacturing lightweight Carbon Fibre steering wheels/tillers for boats and inlay panels for high-end yacht tenders. We have performed repairs for a wide variety vessels including yacht/dinghy masts.

» **MOTORSPORT**

We have designed and manufactured various products for racing applications such as air boxes, bodywork panels, diffusers and wings which have also been wind tunnel tested. In addition, we are also equipped to provide a repair service, working to tight deadlines which is a must for the Motorsport industry.

» **SAFETY**

Due to Carbon Fibre's unique energy dissipation properties, it is a material that is increasingly being used for safety equipment. Examples include; motorcycle helmets and race car crash structures.

» **SPORTING/LEISURE**

Carbon Fibre is used within many sports for its strength and lightweight or tuned "flexure" properties.

» **TELECOMMUNICATIONS**

Manufacturing portable EMC/EMI compliant satellite dishes & electronic cases for demanding military applications that are required to work in severe conditions.

» SUB-CONTRACT CLIENT PROJECTS



COSWORTH

Cosworth Electronics selected us to manufacture Carbon Fibre CCW MkII steering wheel components, Cosworth's new Carbon Fibre steering wheel with integrated colour display;

- » Vivid and sunlight-viewable, featuring a large 4.3" full-colour 900 nit TFT.
- » Customisable displays with configurable pages, controls, alarms and images.
- » Vibrant RPM and alarm indications from 14 tri-colour LEDs with full RGB control.
- » Software-configurable button and dial functions.





The FIA and ACO recently chose the 2016 Le Mans 24 hour race as the venue to launch the new LMP2 2017 - 2020 engine by UK-based engine design and manufacturer Gibson Technology Ltd.

Gibson has developed and will manufacture the new 4.2 litre V8 GK428 engine, supplying all LMP2 teams in the FIA World Endurance Championship (WEC), including the Le Mans 24 Hours, as well as the European Le Mans Series (ELMS) and the Asian Le Mans Series (from 2019 onwards).

TESTIMONIAL FROM GIBSON

"Reverie has been selected by Gibson to be the sole composites manufacturer/supplier for the Engine Air box lower tray, Air box Mid-section and the LH and RH Coil covers. Reverie were selected due to proven supply, quality and quick response to technical queries on previous Gibson projects coupled with fair pricing and good upfront technical composites design for manufacture/tooling advice. Dave James, our purchasing manager, also commented on Reverie's excellent customer service, rapid attention to any concerns and ISO9001 approval."





We manufacture Lazer Carbon Fibre lighting pods which contains 4 x adjustable 6 LED lights. The lighting units are used on M-Sport WRC rally cars, seen below fitted to the WRC championship winning Fiesta, 2017.





 **QUAIFE**

Quaife selected us to make Carbon Fibre flywheel covers for their gearboxes. The image above shows a concept gearbox designed for high power/torque transaxles for the increasingly common use of big US V8s such as the LS series.

(Image, left) The popular Mini Challenge gearbox, of which 60 have been made so far, with a lightweight Carbon Fibre flywheel cover integrated with cast bell housing fingers.



Between 2003-2005, for Foggy PETRONAS Racing, we manufactured 150 full panel sets (inc. structural seat unit) for the road homologation special to allow the FP1 bike to meet the requirements of the FIM. During this period, we employed 20 full time staff and 6 F1 contractors. All delivery times and quality targets were met by our production staff and to both the OEM and FP1 race team.





OPENWORKS

In early 2018, Openworks Engineering selected us to manufacture their Drone Capture System, the SkyWall100.

The SkyWall100 system allows operators to physically capture any suspicious drone and bring it to the ground safely, without raising alarm in the surrounding area or causing collateral damage.





In 2008, Gigawave Motorsport selected us to repair the Carbon Fibre body panels for their Aston Martin DBR9 GT1 racing car which competed in the FIA GT championship.

We were required to regularly repair all body panels including splitters, floors and diffusers after suffering significant damage. Our team turned around the repairs in record time as the car was needed for up and coming races.

Gigawave Motorsport finished 3rd at Silverstone and 3rd again at Monza in the 2nd round.

We undertake all sorts of Carbon Fibre Motorsport repair work in all categories of the sport including LMP1, LMP2, GT1, GT2 and GT3.





(Top left image & below) Vislink/IMT selected us to manufacture the autoclaved Carbon Fibre chassis for the motorised Mantis MSAT, a lightweight, portable satellite terminal that can be set-up anywhere to provide secure and non-secure data and video transmission in as little as five minutes.

It supports X and Ku-Band configurations ensuring worldwide coverage is available at all times. Frequency bands can be swapped in the field in under a minute. The Mantis is designed for rapid deployment in hostile environments.



(Bottom left image) Also for IMT/Vislink, we manufacture the casing for the HHT3 Handheld Receiver which has a rugged, light-weight Carbon Fibre autoclaved construction and a 12" ultra-bright daylight HD screen.

The unit is designed for reception of airborne down-links, surveillance and onboard wireless cameras.

The unit decodes MPEG2 and H.264/MPEG4 video.

Jules Sturgess

As an example of our involvement in lifestyle products, Jules Sturgess Design selected us to make high-end designer chaise's, the 'Marea', each of which were made from twenty two layers of three different weaves of Carbon Fibre pre-preg. More recently, we have been involved in the Poleiro bar stool (*images, right*) which features a CNC machined, thermoformed PU core with high modulus UD fibres to give the seemingly impossible slim structure the strength to support. This, along with the Marea chaise, featured at the London Design Festival 2017.





BOLIN • WEBB

Bolin Webb selected us to manufacture the Carbon Fibre top panel for their exclusive X1 Carbon razor, available on Bolin Webb's website.

The Carbon Fibre panel is hand laid, cut, cured and carefully trimmed to size. The panel is then hand sprayed with five layers of acrylic clear coat for long lasting quality.

rega

“To achieve the absolute pinnacle of Hi-Fi turntable design, we had to call upon four decades of research and engineering experience. Seeking the best possible material for each individual component, meticulously researched and prototyped until the ultimate performance was achieved. Exotic materials such as zirconium, titanium, and carbon fibre are used throughout.

Realisation of the unique Naiad plinth is entrusted to Reverie’s skilled pre-preg laminating technicians. Many layers of carefully CNC cut Carbon Fibre are hand-layed over a Rohacell foam core before Autoclave curing. The rigidity and low mass of the design minimises the storage and transference of unwanted vibrational energy into the rest of the turntable.”

- Phil Freeman, Company Coordinator

Embedded on the top and bottom of the plinth are two Aluminium Oxide ceramic braces linking the base of the tone arm to the main platter hub bearing. These braces form a stressed beam structure that helps the tone arm extract more information from the Vinyl record than ever before.



REGA Carbon Fibre
turntable wall bracket





We are unique among composite manufacturers in that we design and manufacture our own extensive range of Carbon Fibre products and accessories for fitment to Lotus cars and universal motorsport applications.

Some of our products include; FIA approved seats, high performance air boxes & plenums, Carbon Fibre steering wheels which have been used in the WRC, diffusers, wings, and bumper canards.

Our full product range can be found on our website or via our worldwide dealer network. Our website also contains more information on our composite manufacturing capabilities and services.

We look forward to hearing from you to discuss your next project.

» CUSTOMER TESTIMONIALS

"Reverie Limited has been selected by Gibson to be the sole composites manufacturer/supplier for the engine air box lower tray, air box mid-section and left and right-hand coil covers. Reverie were selected due to proven supply, quality and quick response to technical queries on previous Gibson projects coupled with fair pricing and good upfront technical composites design for manufacture/tooling advice".

Dave James - Gibson Technology Ltd




"We are delighted with the support and service that we receive from Reverie in provision of moulded and CNC machined Carbon Fibre for our steering wheels, including CWW277 Mk1 and Mk2. We have been satisfied with the quality and efficiency of their work, which in turn has enabled us to maintain the high standards for which the Cosworth name is internationally renowned."

Anny Kirk - Cosworth Electronics Ltd

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