Cobra Factory Audit Report by Bas Edmonds, the Chief Measurer of International RS:X Class Association

Working Party Objective

The goal of the working party was to come up with a solution in order to provide the class with a reliable and consistent 66cm fin that represented value for money for the sailors. Any solution would need to be repeatable over a significant period of time such that the fins used for initial testing could be replicated for a significant period of time with confidence. The solution would also need to be as close as possible to the existing QC parameters of the existing fins with regards to twist and flex to avoid the need for a new revision to the fins. The working party determined that Cobra was the best manufacturer in the short term to provide a solution, given their past experiences with RSX fins.

Background

At the 2018 AGM, a working party was set up to review and resolve the issues with the 66cm fins where there were serious concerns over reliability and consistency. The 60cm fin was not included within the scope of the working party. Test fins were produced by Cobra and were sent to three nations for testing over November/December. Initial feedback was that there was a significant improvement in the reliability, with none of the fins seeing any form of failure, cracking or bubbling as per previous fins. Consistency remained a concern with teams reporting differences in the fins, but nothing more significant than previous editions.

The RS:X Executive, at its meeting in early December, agreed to approve production of the fins but requested that Bas Edmonds go to Cobra as soon as possible to look specifically at the consistency issues and also to validate the changes made in production with regards to reliability.

Key Developments – as of 14 January 2019

Upon arrival at the factor on Monday 14th January 2019, the following have been identified by Cobra as key developments that have been undertaken to improve the quality of the 66cm fin.

1. Additional Staff

   Cobra have employed the support of additional expertise to support Paolo Cecchetti with the development of the RS:X 66cm fin. These include Jean Jaques Deboichet and Thomas Davies. This development is key to the ongoing success of the fin project as it will have direct continued oversight from very experienced staff to ensure that the standards as set are continued to be rolled out. A brief overview of these two staff members and their involvement is detailed below.

Jean Jaques Deboichet has been building fins and boards for over 40 years. Graduating as a mechanical engineer JJ has been building slalom, formula and race fins for the biggest names in the sport over the years, with his fins winning countless world cup races and titles. He has also been working commercially in the mass production of carbon fins and foils since early 2000's and is now bringing this experience back to Cobra to support their fin and foil production as R&D Manager with a focus on the premium carbon products like the RS:X fins and 100% carbon Foils. Within the RS:X project, JJ's experience will be an obvious asset in further improving quality and consistency across the production and QC.

Thomas Davies comes from a background in Freestyle and Wave Windsurfing and has spent thousands of hours on the water over the years and has won a few national titles in Wave and Freestyle. Thomas has worked building boards for both existing brands and tech start-ups working on robotic production solutions and also spent time working as product manager and account manager for Gaastra and Tabou. Thomas is currently completing his masters in Product Design and Process development is working as a project manager for the RS:X 66 upgrade, reporting to JJ and Paolo but with more time to be 100% involved in the process and continued improvement of the production.

When Thomas steps away from the RS:X project at the end of February, JJ will still be active on the factory floor for to check product and process consistency along with Paolo. Additionally to that there will be ongoing support from the Cobra D&D Engineers most likely Prasop and an engineer from the building 5 team (Porntip Sareebut) who will manage daily issues and process for both the RS:X 60 and 66 fins.

2. New Layup

When the method of manufacture changed from pre-preg to resin transfer moulding (RTM), the same layup with regards to materials was used. This led to inconsistencies in fin performance as the resin was not always pulled/pushed through the fin consistently – which also led to fin failures where dry spots occurred in the fin layup.

To counter this, Cobra have completely re-designed the fin layup and base materials which allows for a better pull/push through of the resin which increases the consistency of the product which in turn has also increased the strength.

3. Refined Process for Infusion

Whilst Cobra have been using RTM as a production method for other applications for number of years, it had not fully anticipated all of the technical challenges with adapting the method to fin production. Along with the layup changes, further changes have been made to the Workers Instructions with regards to how to layup the fins, checking mould temperatures and timings for resin mixing. These instructions are made available to the team involved in the manufacturing of the fins and designed to ensure that the exact same process is followed in the layup and infusion of every fin produced.

The infusion process also includes new process with regards to the handling of the resins, degassing prior to infusion, and indicative timings of infusion as well as set cure times. There

remains a human element to the whole process which cannot be exactly detailed, but Cobra have ensured that the same three staff members are solely responsible for the infusion of every fin built and have over 18 months experience.

4. New working environment

The production room for the infusion process has been upgraded and moved within the Cobra factory. The infusion process now takes place within a temperature controlled room with a 2 degree range on operating temperature as well as controlling the humidity at which the materials and resins are used. As the climate in Thailand is very variable, with hot, dry and humid conditions, the weather can have an effect on the materials that are used prior to and during production – which is offset by the new production room. This room is used exclusively for RSX fin production.

5. Upgrade to Machinery

Cobra have also invested in RS:X specific machinery such that specific controls can be placed on the manufacturing of RS:X fins. This includes a specific oven for curing the fins within where previously this had been shared with other fins in production. This allows for a specific temperature for RS:X fins to be cured in – without also having the door opened frequently to remove other fins.

The RTM moulds are also temperature controlled with a water heater, meaning that both the top and bottom moulds are at the correct temperature for the resin and infusion process from the moment the mould is closed.

Finally, a resin degassing chamber has been added to the process which pressurises the resin to a certain level which in turn looks to remove bubbles from the resin prior to infusion which creates a smoother pull through of the resin.

Observations

1. Cobra Report

Cobra provided a report to Bas Edmonds and Bill Lee (Neil Pryde representative) on the amendments made to the fin production process. This report detailed both the materials involved within the production of the 66cm fin including the resin used. The report also detailed the infusion process which is a shortened version of the Worker Instructions which is a step by step walk through of how to build a 66cm fin. Finally, a detailed laminate schedule was included within the report which was shown as Revision 6 (7^{th} revision of the RTM process). Due to the confidential nature of this report, it is not able to be submitted as part of this audit report.

During the visit, all aspects of the report were validated to be correct, in use and that it formed a part of the working process of building a 66cm fin. The laminate schedule was checked during the manufacturing process, the resins were checked prior to infusion (including the

mixing and degassing process) and the following of the Worker Instructions was checked to be correct and followed by the staff.

The results of the amendments made to the infusion process of the 66cm fin is an acceptable method of ensuring that the resulting product is as consistent as possible in terms of shape and performance parameters once it has been removed from the mould. This is based on the assumption that all of the written process are followed diligently every time.

2. Finishing

In reviewing the process of manufacturing, an area of inconsistency was identified in the trimming and 1st sanding of the fin. The fin comes out of the mould with a small excess of fibre around the outside of the fin. The lip is too thin to use a mechanical process to trim and therefore it is required to finish by hand. The method of trimming this lip was noted to create differences in the symmetry of the leading edge.

A new process should be implemented for the 1st trim of the fin. This should be a clear and detailed process, with training that is associated with it, to ensure that the final hand sand of the fin is done consistently and with respect to the symmetry of the fin.

In addition the process for first coating and subsequent sanding of fins should be controlled in the same manner. This includes the first fill of the fin which currently has the ability to affect the shape and consistency of the fin.

New templates should be made up to control the leading edge shape more accurately an included as part of the QC process. The templates that the class had previously used for 2015 WC and 2016 Olympic Games have gone missing and need to be replaced. If new templates are made, a second set should be made and sent to the RS:X Class for use at events.

These processes and templates should be reviewed and implemented as a priority.

3. Quality Control

The quality control for the fins should be reviewed and amended to show a tighter tolerance with warning systems built in to track whether production has slipped to “old routines”. These warning systems or alarms are tighter tolerances but do not reject fins. When a certain number of fins within a batch breach the alarm, this should prompt Cobra management to review the fin production to make sure that all systems and processes are still being followed.

4. Development

During the audit discussions were had on further changes and improvements that could be done to the 66cm fin. This caused some concern in that the RS:X Class and Neil Pryde would like a consistent product for the remainder of this Olympic cycle, rather than having different iterations of fins being drip fed into the class. As part of this discussion it was

agreed to identify different actions of production and close areas o f testing/development down so both the Class, Neil Pryde and Cobra were in agreement of permitted actions.

Action	Permission	Effect
Materials specification for layup	CLOSED	N/A
Layup design, including shaping of layers	CLOSED	N/A
Process for infusion	In refinement – process needs some minor tweaks with regards to controls and effective implementation	None- looking at improving consistency
Resins for infusion	In refinement – resin is being reviewed to have a quicker cure time which is aimed at speeding up production	None
Staff involved in infusion	CLOSED – training of additional staff is ongoing but key manager to remain the same	N/A
First sand and coat	Development – this needs a new process to support a more consistent product.	Will see minor differences in the leading edge shape, but only towards the designed shape and better consistency
Second sand and coat	In refinement	None
Staff involved in sanding and coating	In refinement – staff will need training to new process	None
Finishing	CLOSED	N/A
Quality Control	Development – new QC controls need to be implemented as well as data control sheet.	Better data for Class and Neil Pryde

Overall

The work that Cobra have done to improve the durability of the fin is without doubt a significant step in the right direction. There are small procedural steps and minor changes that could be done to further improve this which Cobra are undertaking. These changes should not change the overall performance of the fin but look to improve its consistency only.

The shape consistency is a known issue that remains open and the steps identified during the audit should look to improve the overall shape consistency of the fin. The addition of Thomas and JJ to the factory will allow Cobra to review this process and implement the correct amendments to improve this.

Cobra are aware that high standards are difficult to maintain over a period of time and the warning systems built into the QC process, if used correctly, should enable Cobra management to efficiently continually review the construction of the fins.

Thanks goes to Bill Lee from Neil Pryde, the RS:X Class Association and all of the staff at Cobra for their support during the audit.

Bas Edmonds
RS:X Class Chief Measurer

21st January 2019