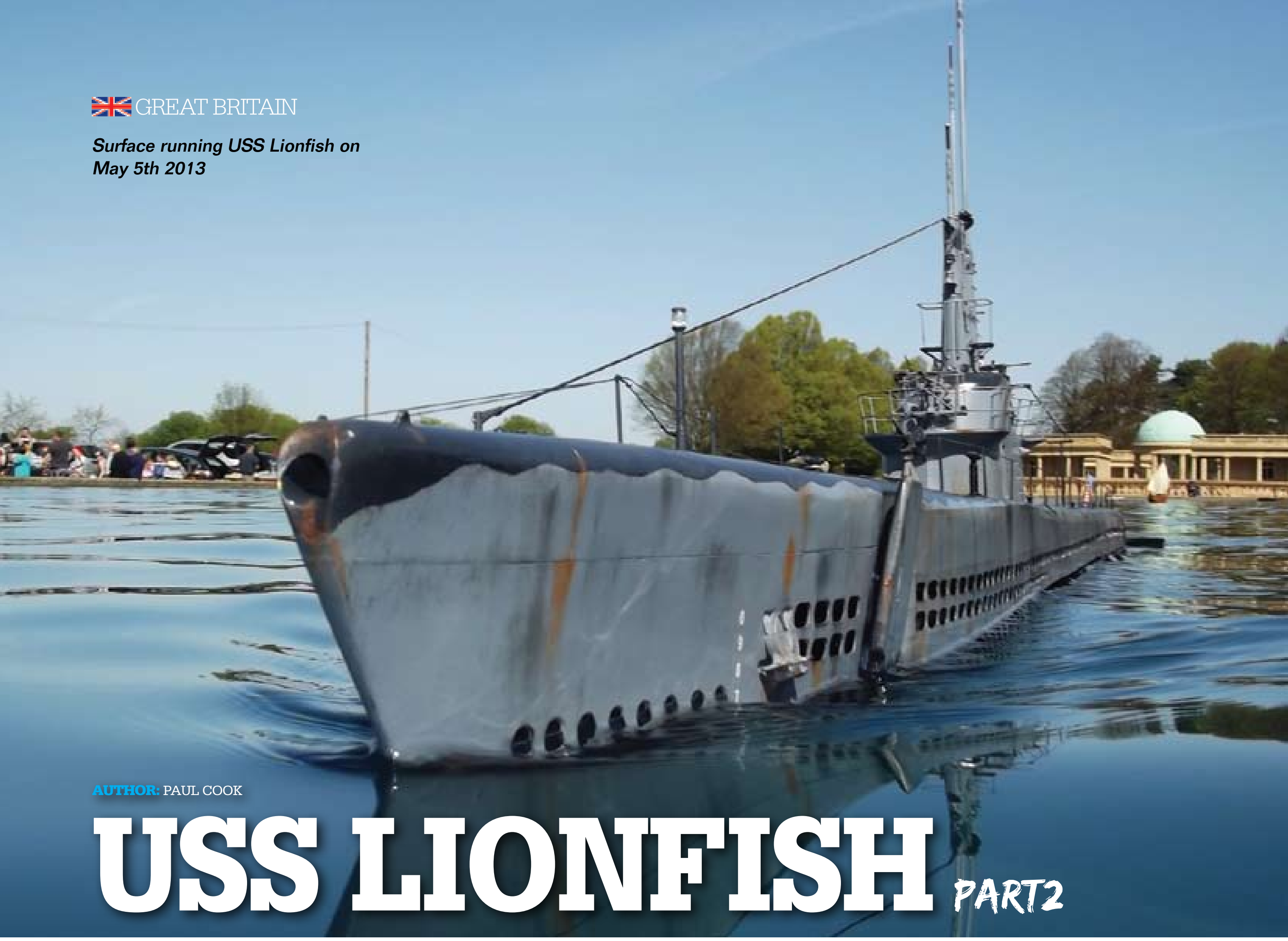
GREAT BRITAIN



Surface running USS Lionfish on May 5th 2013

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USS LIONFISH PART2

IN THIS SECOND PART OF A THREE-PART ARTICLE, PAUL TELLS THE HISTORY OF USS LIONFISH AND THEN DESCRIBES HOW HE INSTALLED THE CONTROL SURFACES, DRIVE MOTORS AND PUMPS INTO THE HULL. HE ALSO DESCRIBES THE RADIO SYSTEM NEEDED.

A BRIEF HISTORY OF THE FULL SIZE USS LIONFISH

While the gasket seal fully cures there is an opportunity to briefly review the history of the full size craft.

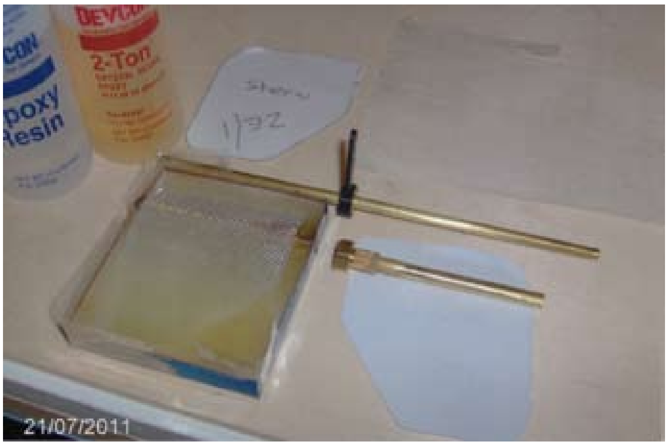
Lionfish (SS-298), a Balao-class submarine, was the only ship of the United States Navy named after the lionfish, a scorpaenoid fish found in the West Indies and the tropical Pacific. Lionfish was laid down on 15th December 1942; launched on 7th November 1943, sponsored by Mrs Harold C. Train; and commissioned on 1st November 1944.

Her first captain was Lieutenant Commander Edward D. Spruance, son of World War II Admiral Raymond Spruance. After completing her shakedown cruise off New England, she began her first war patrol in Japanese waters on 1st April 1945. Ten days later, she avoided two torpedoes fired by a Japanese submarine. On 1st May Lionfish destroyed a Japanese schooner with her deck guns. After a rendezvous with the submarine USS Ray, she transported B-29 survivors to Saipan and then made her way to Midway Island for replenishment. On 2nd June she started her second war patrol, and on 10th July fired torpedoes at a surfaced Japanese submarine, after which Lionfish's crew heard explosions and observed smoke through their periscope. The Submarine I 162 was undamaged. She subsequently fired on two more Japanese submarines. Lionfish ended her second and last war patrol performing lifeguard duty (the rescue of downed fliers) off the coast of Japan.

When World War II ended, she headed for San Francisco and was decommissioned at Mare Island Navy Yard on 16th January 1946. Lionfish was re-commissioned on 31st January 1951, and headed for the East Coast for training cruises. After participating in NATO exercises and a Mediterranean cruise, she returned to the East Coast and was decommissioned at the Boston Navy Yard on 15th December 1953. In 1960, the submarine was re-commissioned a second time, this time serving as a reserve-training submarine at Providence, Rhode Island. In 1971, she was stricken from the Navy Register. In 1973, she began permanent display as a memorial at Battleship Cove, Fall River USA, where she is one of the museum's most popular exhibits to this very day.

CONTINUING WITH THE MODEL – MECHANICS OF THE BOAT

The 32nd parallel hulls were never what you would call a comprehensive kit – they were indeed aimed at the more experienced modeller. So a lot of it you had to make yourself and this is what put me off them back in 1989. With this hull I only got the rudder and the diagrams on the plan that was with it. So the bow hydroplanes, folding mechanism and the stern planes had to be made from scratch. I had, in fact, made the stern planes one afternoon a good few months earlier with the help of a good friend. These were made by simply casting epoxy resin in a cardboard mould, with a core of aluminium mesh. The brass tube runners, with soldered coupling ends with a grub screw fitting were cast into



Stern planes under construction

Completed stern planes with control mechanism

Components for the bow planes and mechanism

them. The control arm is an item available from any good model shop. The end result was more than acceptable. I have not got many photographs of these items on the full size boats, as you don't see them normally!

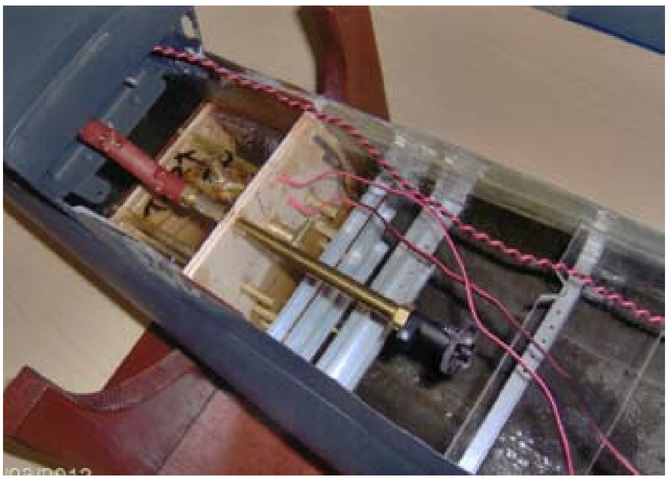
The bow hydroplanes were a little more complicated to make as, of course, they needed to fold as well. Being the design they were, it took a little more thought and planning to combine the folding mechanism with it. What you need to bear in mind is this – I am no engineer – but your average modeller and I try to use as much 'off the model shop shelf' as possible as you will see in the pictures. I did some research on the Internet and found some pictures of what other people had done with Gato bow planes, indeed Engel of Germany actually make and sell a bow plane mechanism, but it's quite a bit smaller. From the pictures that I had seen, I knew I could make my own bow plane mechanism and the planes themselves. Using the Revell 1/72 plastic kit I scaled up the bow planes to 1/32 on paper using a photocopier. Easy!

Using aluminium sheet I made four halves of bow planes. These had a middle backbone of aluminium mesh placed inside and were then taped together with masking tape. Warmed epoxy was poured in until they filled, being very careful not to get any air bubbles in along the way. These were left to cure whilst I got on with the other parts (see photo). The folding mechanism itself was made up of the three pieces of aluminium sheet, two Graupner racing gearbox gears, three control arms, a few screws and job done. Setting the radio using the 'end point adjustment' feature of the channel and physically fiddling with the mechanism took a bit of time to get right, but this was to be expected.

SELECTING THE CORRECT SERVO

You will see from one of the photographs that there is a small hole to the left corner of the aluminium plate along with a nylon control arm on the front of the vertical plate. This was to accept a bell-crank that would run from the standard Futaba 3003 servo. However, in testing, the model aircraft type nylon bell-crank would not move the tiller arm in a clean manner. It would appear to start, then stall, then move again. I did wonder if the servo was not up to the job at one point. A quick and easy solution was to lose the bell-crank and tiller arm and drive the gears directly using a standard model boat prop shaft and an offset Dyco type coupling. Space near the top of the watertight section was limited. An electric flight motor mount and a standard Futaba servo on its side were employed to drive the gears directly. But again, on testing, the standard Futaba 3003 servo did appear to struggle at the extreme

Mechanism for the bow planes



The shaft from the servo to the bow planes

The servo and shaft for operating the bow planes

The main drive motors, props and prop shafts

A view of the stern with the props and shafts in place

ends of the movement. The answer was replacing the Futaba 3303 with a higher-powered Futaba 3305 metal-geared standard servo – this did the trick, but it cost me a few more pennies mind you!

After a bit more re-programming of the Futaba 14MZ transmitter it worked perfectly every time on testing with no stalling of the servo. To raise or lower the bow planes, I simply flick my channel 12 switch, which folds them. The channel is also slowed down to 15% with the inbuilt servo retarder in the computer – they do look very good when raising and lowering and they are not too fast either! The transmitter also plays sound files on each channel – when the bow planes are to be lowered for diving, a klaxon horn sounds and you hear Burt Lancaster from 'Run Silent, Run Deep' shout "Clear the bridge, dive, dive". This is just one of 24 sound clips within this model's menu in the Futaba 14MZ transmitter.

THE DRIVE MOTORS

The main drive motors, that I had already purchased some time back, were now to be fitted along with the 5 mm prop shafts, tubes, 'A' frames and the 75 mm props. The fitting of these as you would imagine was not too much of a fuss. My main issues were making sure they had all lined up correctly with the scale hull plates on both sides. Dry fitting, then checking, then checking again is the key. On all of my models, I tend to use a dab of cyano to just 'tack' these parts in place. Then check again before even thinking about going for a full permanent fit. Once fitted and glued properly in place, I used Milliput and more lithoplate to fair them in on the outside, whilst fibreglass matting and resin were on the inside, partly for strength and partly to seal the prop tube exits in the watertight section.

The motors were a pair of Robbe Geared Power 700s, these had gearboxes fitted that were 3.7-1 ratio. The motors were mounted on commercially available mounts; these mounts were set very low in the hull to keep the weight down low.

On 6 volts the Robbe 700 motors give the boat plenty of power, indeed in practice she will run at a brisk walking speed on one alone! The motors are in fact 12 volt rated, if I were to use 12 volts, it would have been a racing submarine! The main drive motor batteries were to be a pair of 6 volt 12 Ahr sealed lead acids mounted in the free flooding section of each hull.

The prop shafts, etc., were purchased from G.T. Sitek, who often advertise within this magazine. The quality of the items was superb, as you would expect from a long running company such as this. Once the main shafts and motors were in, it was time to move on to fitting of the main electrical equipment and R/C gear.

The main drive motors

ELECTRICS

A 12 volt 7 Ahr sealed gel battery was fixed into the bottom of each main radio section, as these are 2 kg each, they were carefully set equidistant from the centre of the boat. Although I should point out that these batteries are on a set of Velcro'd aluminium rails, so they can be moved fore and aft if needed. I had in the early days considered having the batteries moveable by either servo or worm drive, but dismissed the idea and opted for trim tanks instead. These batteries were to power the main ballast pumps, trim pumps and the 12 volt solenoid valves that could be fitted later if needed. Next to go into the very bottom of each watertight section were the Kavan pumps for the trim tanks. My choice to go with the Kavan pump was experience in use – at £29.99 each, they are not cheap, but I trust these pumps. Each trim tank is run totally independently via channels 10 and 11 on the transmitter, although they can be switch-mixed to run as a pair of flood tanks if needed, such is the beauty of using a computerised transmitter as I have done since 1996.

Next to go into each watertight section were two Kavan pumps (another four). These four pumps were to flood and empty the main ballast tank. All of the pumps in the boat are being run from commercially available electronic speed controllers, both forward and reverse function, of course. In one of the photographs you can just see the aft trim pump in black, along with two of the pump ESCs in blue hanging over the side of the hull. The two yellow items in the middle of the rear section are the twin ESCs that run the main drive motors. Once again using the mixers in the Futaba radio, the throttles can be used as a pair of twin throttles - they can be switched where either one of them is the 'master' to the other, or I can use the rudder channel to mix the power. This gives the ability for this 9 ft 9" beast to almost spin on the spot just using the rudder! Not a bow thruster in sight. On testing during the summer of 2012, many people saw this at my club and asked me, "Can my transmitter do that?" Many boat modellers have good transmitters but as they are designed for aircraft the language does not always help them to get the best out of it.

Just above the two main drive ESCs is the 14-channel receiver, it's a 40 MHz Futaba 5014 DPS receiver. This is not a receiver many of you will be familiar with. It has twelve main proportional channels, two digital channels and is totally crystal-less. It's not synthesized either. The channel is set by a system called WFSS (Wireless Frequency Setting System), used very much like Bluetooth on your phone, but encrypted in the transmitter are the serial numbers on the receivers which you have to set-up for that model memory code yourself. To change frequency the transmitter and receivers (in this case) have to be within a few inches of each other. I simply select a frequency within the 40 MHz band and 'send' it! On the transmitter I then have to agree the 'send', otherwise it will fail and stay on the same frequency that it was already on. This then does not allow an accidental change of frequency by another transmitter in close proximity to me. Don't forget this is primarily a model aircraft transmitter, so safety is paramount. The frequency modulation used is PCM G3, used by many model jet flyers that have not yet got onto 2.4 GHz!

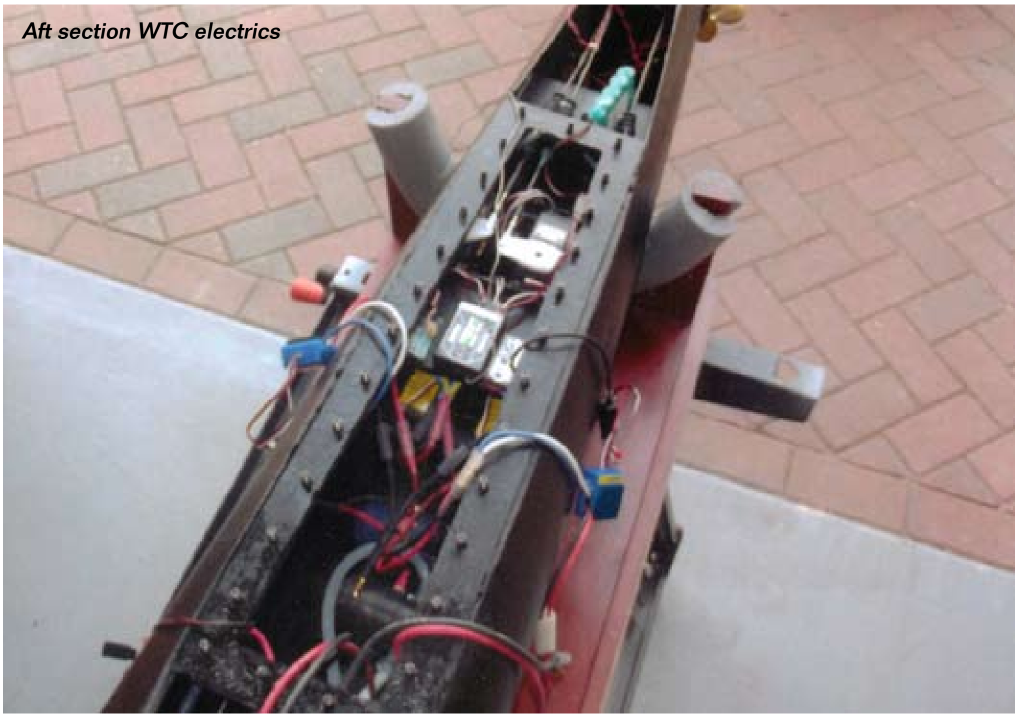
On the left in one of the pictures, next to the receiver is the Subtech APC-4 Leveller, I have used these levellers on several models and find them to be very reliable. This one is set into my channel 8 slider, this then enables me to fine adjust the stern plane trim from the transmitter if needed.

Behind the receiver and leveller are the rudder and stern plane control servos. Due to the size of the rudder and stern planes, I used the Futaba 3306MG high torque metal-geared servos. These were fitted and screwed into the pre-drilled main servo rails that had been fitted several weeks and months earlier. You will note that all the radio gear is installed into the model high up, only the batteries, main drive motors and pumps are anywhere near the bottom. With any submarine model it's always best to be prepared for any leak that may occur – despite your every best effort to avoid it. Making sure that any leak that could occur cannot get onto sensitive electronics is always a good thing. As you may remember from earlier in this article, I said that each section would have its own receiver and power. All that you see in the stern section is more or less replicated in the forward section - effectively they are separate R/C models on the same channel bolted together. Obviously the forward section does not have twin drive ESCs or a leveller in it. The receiver in the forward section has the channel slots empty where the rear section has used that channel and vice-versa.

Linkages to all the control surfaces were done through traditional style rubber bellows. I used the Robbe ones on this model as they have the largest hole. Control rods to rudder and hydroplanes were 3 mm carbon rod with metal clevises at each end – these are very stiff and give no flex at all, so I have very positive control on each control surface.

Once everything was in place, bench setting of all the pumps was done to check that each command on the transmitter enabled each pump to pump the water in the right direction. This is where you need to steal the kitchen washing up bowl, without your missus noticing! Just simply run a pipe from bowl to pump inlet. Out of the six pumps in the model only two needed the ESC wires turning round to achieve the correct flow direction. All of the servo and motor ESC's directions had been corrected during installation using the servo reverse menu in the transmitter. After this, I spent a few days fiddling with servo settings in the transmitter to get the best from each control surface. Next to tackle was the finishing of the model.

Next month Paul will describe the external finishing of the hull and the testing and balancing needed to get the craft to run and dive.
MMI


Aft section WTC electrics