

Model Yachting

A Quarterly Publication of the American Model Yachting Association, Special 2006 Issue Number 142

US\$7.00



Featuring

Design &
Construction

On the Cover

This issue of *Model Yachting Magazine* features articles about Design & Construction of R/C Model Yachts. Each article addresses a specific class of boat, but all of this can be applied to all classes. We had a great abundance of article submissions, so the balance will appear in Issue 143.

On the front cover is a photo from the 2005 International One Meter, US NCR, another great photo by Del Perena. You can hear skippers hailing: "Starboard! Starboard!" More often than not, the port tack skipper is concentrating too much on boat speed and not enough on keeping clear of right-of-way approaching starboard boats.

The American Model Yachting Association (AMYA), a not-for-profit organization that is dedicated to promoting the designing, building, racing, and preservation of all model sailing yachts and is open to all people who are interested in these activities.

In pursuit of these goals, the AMYA publishes *Model Yachting Magazine*. *Model Yachting* is published four times per year in accordance with the AMYA calendar. The staff of the magazine is composed primarily of AMYA member volunteers who devote countless hours of their time to produce this publication. Editorial policy is ultimately determined by the AMYA Board of Directors; however, the views expressed in this publication do not necessarily represent the views of the Executive Board, the Board of Directors, or the majority of the AMYA membership.

Advertising in this publication is encouraged as an informative service to the AMYA members and as a means of helping defray the costs of printing. The AMYA does not take any responsibility for any advertiser's products.

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Advertiser Index

3R Discussion Group 18
APAK Batteries 23
Anchor Bay Specialties 27
Black Sails 13
Bob's BoatYard 29
Carr Sails 35
Chesapeake Performance Models 31
Dennis Desprois' R/C Yachts 28
Great Basin Model Yachts 26
GRP Model Yachts 2
Hanna Boats 60
Hartman Fibreglass R/C 27
Hitec 15
Model Yacht Fittings 36
R/C Concepts 33
RMG Sailwinch 39
Traplet Distribution USA Ltd 59
US 12 5
Victor Model Products 25
Vision Sails 28



Contents of Issue 142

The Masthead	4
President's Letter	5
Building Gambit	6
Formula 100 Development	11
Building a Chined Hull	14
Detailed 3R Construction	16
Spektrum DX6 Features & Setup for RC Sailboats	19
Report on the Radio Range of the DX6.....	22
Class News	24
Soling One Meter	24
East Coast 12 Meter	26
Victoria	27
US One Meter	29
Marblehead	30
ODOM.....	31
CR 914	31
36/600.....	32
Santa Barbara	32
Soling 50	33
V-32.....	33
SeaWind.....	33
Fairwind.....	34
Open	35
RC Laser	35
Newport 12 Meter	36
US12	37
AC.....	38
J	38
Ten Rater	39
Wheeler	40
Infinity 54.....	40
US Vintage Model Yacht Group	41
Regatta Schedule	41
Regatta Reports	43
AMYA's Insurance Program.....	53
From the Executive Secretary	54
<i>Model Yachting</i> Editorial Calendar	54
<i>Model Yachting</i> News.....	55
AMYA Business Calendar	55
AMYA Stats & Facts	56
AMYA Yacht Registration Form	56
AMYA Ship's Store Order Form.....	57
AMYA Membership Form.....	58

Next Issue

Star 45

Design & Construction, cont.

Spektrum DX6 R/C System

The answer to frequency conflicts

by Chuck Winder

Summary of Features

In the January 2006 issue of Model Aviation there was an ad for the new a R/C radio system operating at 2.4GHz. "Spektrum" is a new brand added to the existing brands such as JR, Futaba, Hitec, etc. Introduced in 2005 for model car racing, it is now offered for "park flyer" model airplanes. It may very well be the start of a revolution in model sailboat racing, too. Its features include:

1. Forty boats can sail at the same time in addition to those using the thirty-six channels at 75 and 27 MHz. (Actually there are 80 channels at 2.4 GHz, but the radio uses two channels for each boat for higher reliability.)

2. No channel crystals are required.

3. When the DX6 system is turned on it automatically searches for two clear channels.

4. Other R/C radios cannot cause interference.

5. The transmitter (Tx) uses a unique factory-set code to communicate only with its receiver (Rx). There are 4.2 billion different codes.

6. There is no intermodulation interference, including the "23-channel syndrome."

7. Digital signal processing is used. No glitching.

8. Servo travel for both arm and drum sail servos is easily adjusted.

9. Dual rates and exponential rates can be selected for servo travel.

10. Control range is more than 1,000 feet. There is a convenient button on the back of the Tx to test radio performance before sailing.

11. Fail-safe programming will ease the sails if the radio signal is lost.

12. An owner can sail all his boats using one Tx by using a separate \$60 Rx in each boat. Each additional Rx is easily programmed to recognize only its owner's Tx.

13. Cost of \$199.95 includes the Tx, one Rx, four sub-micro servos, a 600 mAh NiCd Tx battery pack and



Spektrum DX6. Like many home telephone systems, the DX6 transmits on the 2.4GHz band. The system features DuaLink™ (pat pend) technology that actually transmits and receives on two frequencies simultaneously, offering multi-path security.

an overnight charger that will charge the Tx and boat batteries.

14. The Tx is a 6-channel programmable computer radio with memory for ten models.

15. The small 6-channel Rx weighs 7 grams and draws only 75 mA.

16. The Tx antenna length is only about 6 inches. The top 3-1/2 inches can be swiveled 90 degrees to present the correct orientation to the boat.

This new technology promises to improve, even further, the RC model sailing experience.

Transmitter Setup for Sailboats

The DX6 is designed for small airplane and helicopter "park flyers." Park flyers are small aircraft, usually electric powered, which are becoming popular world wide. The Spektrum will control six different servos. For boat racing, only two or three servos are typically used. It is also a "com-

puter" radio, which will remember all the settings for up to ten different boat or plane models.

The owner's manual has 95 pages, but most of it is for helicopters and things we don't use such as flaps and retractable landing gear.

After you have checked out all the stuff in the box it is time to set up the transmitter (Tx). To use the radio takes a bit more setup time than the typical radio used for boats.

Caution:

Always charge the DX6's Tx batteries using the charger that comes with the radio. The polarity of the DX6's Tx charge jack is different from most radios. The black wire is positive and connects to the outside of the jack. The negative red wire connects to the center of the jack. Getting the polarity wrong will damage the radio. Unfortunately the Tx charge connectors used by Futaba and Hitec will fit the DX6's jack!

All DX6 programming

Spektrum DX6 RC System

If you cannot find this radio at your local hobby shop, go to:

www.spektrumrc.com

Use *Store Locator*, or go to:

www.horizonhobby.com

Horizon Hobby, Inc.

Attn: Spektrum

4105 Fieldstone Road

Champaign, IL 61822

Main Phone: 217-352-1913

Toll Free: 800-338-4639

Phone Support: 877-504-0233

Mon-Fri. 8am-7pm CST

uses the on/off switch and the two red buttons on the lower face of the Tx. The red buttons are normally centered and inactive. They are pushed up or down to use them. When released, they return to center.

When the Tx is turned on, the LCD screen displays battery voltage at the bottom and the selected model name at the top right. I named the setup for my two boats "BT1" and "BT2". Recall that ten models can be stored.

Model Naming

1- With the Tx off, push up and hold both the red SCROLL and INCREASE buttons, and then turn on the Tx. 2- Push up the SCROLL button until MDL appears. 3- Push up the INCREASE button to show "1" (or any number 1-10). 4- Push up the SCROLL button. The first letter of the name will flash. 5- Push up the INCREASE button to choose the letter you want. 6- Press down the CHANNEL button to select the second character and repeat step 5 above. Only the first two characters can be programmed. The third character (a numeral) is selected in step 3 above when selecting the model. 7- Exit by simultaneously pushing up both red buttons. 8- Turn off the Tx.

Model Type Selection

The DX6 is designed for model aircraft and helicopters. There is no selection for boats, but the "Aircraft" mode works best for our application.

1- With the Tx off, push up and hold both the red SCROLL and INCREASE buttons, and then turn on the Tx. 2- Push up the SCROLL button until TYP appears. 3- Push up the increase button to show "AC" (airplane), not "HE" (helicopter). 4- Exit by simultaneously pushing up both red buttons. 5- Turn off the Tx.

Wing Type Selection (For Boats)

This procedure sets the correct mode for model sailboats.

1- Push up and hold the red SCROLL and INCREASE buttons and then turn on the Tx. 2- Push up the SCROLL button until "MIX WING" or "MIX VTL" appears. 3- Push down the CHANNEL button until "MIX WNG" and "OF" appear on the screen. 4- Exit by simultaneously pushing up both red buttons. 5- Turn off the Tx.

Now that the Tx is ready, it's time to set up the boat.

Setting up the boat

The sail servo uses the Receiver's throttle (THR) connector. The rudder servo uses the aileron (AILE) connector. Plug the battery into the battery connector (BAT). Don't install the Rx in the boat until all programming is complete and tested.

Setting Rudder Servo Direction and Travel

1- Turn on the Tx and then the Rx (It will take about 5 seconds for the Tx to take control of the boat.) 2- Simultaneously push up SCROLL and INCREASE buttons. 3- Push up the SCROLL button to select REV-NORMAL. 4- Push down the CHANNEL button to select AIL. (Aileron is used for the rudder control on boats.) 5- Use the INCREASE button and move the rudder stick until the rudder moves in the correct direction. 6- Push up the SCROLL button to select TRV ADJ (travel adjustment). 7- Push down the CHANNEL button to select AIL. 8- Move the rudder stick to the right limit of its motion. Use the INCREASE/DECREASE button to get the desired travel. 9- Repeat step 8 with the stick to the left.

Turn off the Rx, then the Tx.

Setting Sail Servo Parameters

Adjust sheets so that the servos will not be overloaded during travel adjustment. Both drum and arm servos are easily adjusted.

Setting Servo Direction

1- Turn on the Tx, then the Rx. 2- Simultaneously push up SCROLL and INCREASE buttons. 3- Push up

the SCROLL button to select REV-NORMAL. 4- Push down the CHANNEL button to select THR. (Throttle is used for sail control on boats.) 5- Use the INCREASE button until the sail servo arm (or drum) moves in the correct direction when the servo stick is moved.

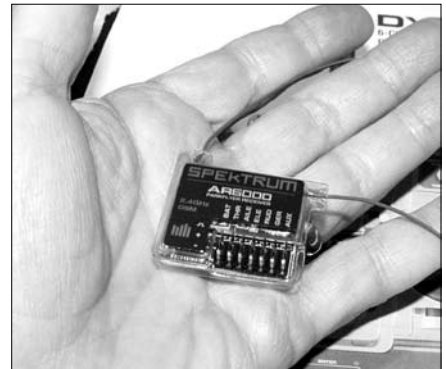
Turn off the Rx, then the Tx.

Setting Sail Servo Travel Caution

Because of the nature of digital trim there is a danger of overload or over travel of the sail servo. The procedure below for a CR 914 is used as an example. The same principles apply to other boats using arm or drum winches.

Setting Sail Servo Travel for a CR 914

1- Turn on the Tx, then the Rx. 2- Push down the sail trim lever until maximum travel is reached (+ or - 40). 3- Simultaneously push up SCROLL and INCREASE buttons. 4- Push up the SCROLL button to select TRV ADJ. 5- Push down the CHANNEL button to select THR. 6- Move the sail servo stick down to the limit of its motion. But, don't let the servo arm hit the keel tube. 7- Use the INCREASE/DECREASE button until there is about a 1/4 inch space between the



The DX6 Rx is Small. Each DX6 receiver is actually two receivers in one, hence the dual antennas. When turned on, the first receiver scans the 2.4GHz band until it finds the transmitter's code, which it has been programmed to recognize (called binding), and locks on that signal. Then the second receiver scans the 2.4GHz band, finds the second transmitted code that it has been programmed to recognize, and also locks on that signal. This whole process takes less than 5 seconds. The receiver is then locked to the transmitter via two independent channels, and is virtually immune to model-generated or outside interference.

servo arm and the keel tube when the sail servo stick is down until it stops. **8-** Move the sail servo stick up until it stops. **9-** Use the INCREASE/DECREASE button until the main boom is hits the shrouds.

Turn off the Rx, then the Tx.

Test the system to assure all adjustments are correct.

Sailing the Boat

Selecting the Model to Sail

If you are using the DX6 to control more than one model, you must tell the Tx which boat you plan to sail. This is how to do it:

1- Push up and hold the red SCROLL and INCREASE buttons and then turn on the Tx. **2-** Push up the SCROLL button until MDL appears. **3-** Use the Increase/Decrease button until the number of the correct model appears. **4-** Exit by pushing up both red buttons.

If you have several models, a cheat-sheet pasted on the bottom of the Tx may be useful.

Radio Performance Check

Put the model on the ground and walk away from it 30 paces, or approximately 90 feet. Depress and hold the "BIND/RANGE TEST" button on the back of the Tx. Operate the sail and rudder servo. The rudder is easily seen at that distance. At 90 feet, with the Range Test button activated, the boat should be in complete control. The radio check can also be done in the water. While holding down the test button, sail the boat away from you until control is lost. Orientation of the Tx antenna will effect the distance at which control is lost.

Antenna Orientation

As with other radios, the strongest signal to the boat is when the antenna is vertical, or perpendicular to the line-of-site to the boat. The DX6 makes that really easy to do. The top portion of the Tx antenna can be adjusted through 90 degrees. If you tend to hold your radio in a horizontal position just move the antenna tip to a vertical position.

Rudder Trim Is Digital

The rudder on most boats is not perfectly centered. The rudder trim lever allows you to center the rudder. But the DX6 trim is digital. When the rudder trim lever is pushed once, a small change occurs. If the lever is held

against the stop, the trim will be much faster. Each time the trim is used, a negative or positive value appears briefly on the screen. If when you have properly trimmed the rudder, the screen shows -16, that setting can be used to set the trim each time the boat is used. (If this value is greater than 20-30 points, the owner should make a rudder linkage mechanical adjustment.)

See **Advanced Programming** to learn how to set the correct rudder trim to read "0."

Advanced Programming

The DX6 offers options that may be useful to you, once you are comfortable with the radio.

Fail-Safe Settings for Sailboats

If the radio signal is lost, the Rx automatically sets the sail servo in the position you have chosen. Only the sail servo position can be set in fail-safe mode. Each owner has to decide what fail-safe sail setting is best for his boat and venue.

1- Turn off the Rx, then the Tx. **2-** Insert the binding plug, which is in the radio package, into the Rx BAT port. **3-** Sail and rudder servos should be inserted in the throttle and aileron ports. **4-** Power the Rx using any unused port. An Rx LED should blink. (The manual says it's a blue light, but mine is amber.) **5-** Turn on the Rx. **6-** Position the sail servo stick in the desired fail-safe position. While holding down the binding button on the back of the Tx, turn on the Tx. **7-** After approximately 5 seconds, the sail servo will go to the fail-safe position. Release the button. **8- Important:** Remove the binding plug and make the correct Rx connections.

Smooth Sail Servo Action

The sail servo stick has a ratchet-like feel. If you prefer a smooth feel, open the Tx back and reverse the ratchet spring strip on the gimbal. The case and ratchet screws can be tight so use care not to strip their Philips heads.

"Sub Trim" For Rudder Trim Reading

The Sub Trim function allows the owner to set the trim read-out on the LCD screen to "zero." When the rudder trim lever is used to center the rudder, there is a reading on the screen giving a +/- value for the trim. If this value is greater than 20-30 points, the owner should make a rudder linkage

mechanical adjustment.

Example: Assume that the screen trim reading is -16 when the rudder is centered.

1- Simultaneously push up both SCROLL and INCREASE buttons. **2-** Push up the SCROLL button to select "SB-TRIM". **3-** Use the Increase/Decrease buttons to show -16 on the screen. (When the value -16 is used, it tells the radio how much correction to use to make the trim reading show as zero when using the radio.) **4-** Push up the SCROLL button to select TRV-ADJ. **5-** Simultaneously push up the SCROLL and INCREASE buttons to exit.

"Dual Rate" For Rudder Control

Dual Rate (D/R) is a feature that lets the skipper change rudder sensitivity by the simple use of a switch. We all know that each time the rudder is deflected, the boat is slowed by rudder drag. By choosing a less sensitive setting, there is less rudder motion.

The D/R switch is located at the upper right of the Tx face and labeled "AILERON D/R". The switch has two positions; "0" and "1." Position "0" is normally used for the higher, or more sensitive, rate. Set it up as follows:

1- With the Tx off, push up and hold both the red SCROLL and INCREASE buttons, and then turn on the Tx. **2-** Push up the SCROLL button until "D/R SW" appears. **3-** Push up the INCREASE button to select "E.A." **4-** Push up SCROLL to select "MIX WNG." **5-** Push up the SCROLL and INCREASE buttons to exit. Turn off the Tx.

The above sets the Tx to use the "AILERON D/R" switch for the rudder.

1- Turn on the Tx. **2-** Simultaneously push up both SCROLL and



The AR6000 receiver comes with the DX6. Compared to the receivers most of us are used to, the AR6000 is tiny. Weighing in at 7 grams (1/4 oz), it's probably the lightest receiver made.

INCREASE buttons 3- Push up the SCROLL button until "D/R" and "A I 0" shows on the upper screen. The "A I" stands for aileron (used for rudder on boats). The "0" indicates switch position "0." "100%" is displayed at the bottom of the LED screen. This means that in switch position "0," rudder stick movement will move the rudder 100% of the original rudder travel chosen in "Setting up the boat." 4- Move the "AILERON D/R" switch down to position "1." Screen will show "A I 1" in upper right. 5- Push down the decrease button to select 50% (or any value you choose). 6- Simultaneously push up both SCROLL and INCREASE buttons to exit.

The above sets 50% for rudder travel when the switch is in position "1." Experiment to find the percent setting that works for your boat.

"Exponential Rate" Rudder Control

Exponential rate offers some of the benefits of dual rate at one switch setting. As the rudder stick is moved from the neutral position, rudder sensitivity is low. That is, for large stick movements the rudder movement is small. As the rudder stick is moved further, the rudder deflects at increasing rates until at full stick deflection full rudder deflection is achieved. This characteristic minimizes rudder movements (maximizes boat speed) in straight line sailing, but still gives large rudder deflections when strong maneuvering is required. (A problem with linear "Dual Rate" is that a skipper may forget to move the D/R switch to the position he wants.)

Before setting exponential rudder set both "0" and "1" rudder switch positions to 100% travel as follows:

1- Turn on the Tx. 2- Simultaneously push up both SCROLL and INCREASE buttons. 3- Move the AILERON "D/R" switch up to position "0." 4- Push up the SCROLL button until "D/R" and "A I 0" shows on the upper screen. 5- Move the "AILERON D/R" switch up to position "0." Screen will show "A I 0" in upper right. 6- Use the Increase/Decrease buttons to set 100%. 7- Move the "AILERON D/R" switch down to position "1." Screen will show "A I 1" in upper right. 8- Use the Increase/Decrease buttons to set 100%. 9- Simultaneously push up both SCROLL and INCREASE buttons to exit. 10. Turn off the Tx.

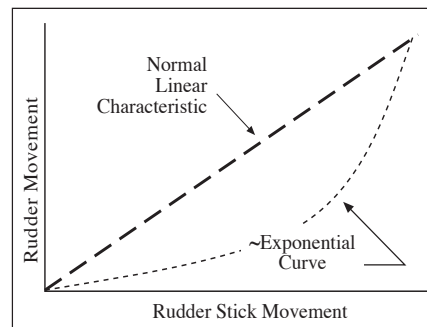
Set exponential rudder as follows:

1- Turn on the Tx. 2- Simultaneously push up both SCROLL and INCREASE buttons. 3- Push up the SCROLL button until "EXP" appears at left of the screen. 4- Push down the CHANNEL button until "A I 0" or "A I 0" appears on the screen. 5- Move the "AILERON D/R" switch up to position "0." Screen will show "A I 0" in upper right. 6- Push down the decrease button to select 0%. (This sets the rudder for linear characteristic (not exponential) when the "0" switch position is selected.) 7- Move the "AILERON D/R" switch down to position "1." Screen will show "A I 1" in upper right. 8- Push up the increase button to select 100%. (One hundred percent (100%) is full exponential. You will have to experiment at the pond to find the rate that works best for your boat.) 9- Push up the SCROLL button until SB-TRIM appears high in upper left of the screen. 10- Simultaneously push up both SCROLL and INCREASE buttons to exit. 11- Turn off the Tx.

That does it. Using "Aileron D/R" position "0" gives full travel with a linear characteristic. Using switch position "1" gives full travel but with exponential rudder characteristic.

Test the settings with the boat turned on.

Enjoy your DX6!



Exponential rate adjustment is a function that allows you to tailor the response rate of the controls when compared to the stick inputs. The adjustable range of the DX6's exponential rate function is from 0-100%. Zero percent (0%) means the response rate is constant throughout stick movement. One hundred percent (100%) is the highest exponential rate that is available. The higher the exponential rate value, the less servo action, or sensitivity, you will notice around the neutral setting.

Anecdotal Reports on Radio Range of the Spektrum DX6 are Incorrect

by Chuck Winder

Some in the model sailing community seems concerned that the DX6 does not have sufficient range for model sailboats. A possible reason is that the earlier DX2 version did occasionally have a range problem. My CR 914 has a range significantly longer than 500 feet with the standard Dual DX6 Rx inside the boat.

Rob Guyatt, RMG Sailwinch <www.rmgsw.com>, in Australia writes:

"I have used the DX6 only once but from that I suspect that the range is not a problem. What I did was just stuff the Rx and the two antennas into the radio pot in my Disco IOM. I mean literally stuffed in because the two antennas were just scrunched up in the pot so that I saw worst case scenario performance. A very quick range test showed a distance of about 150 m (nearly 500 ft) on the water before loss of control. That's plenty. I've heard guys say that they get 1000 ft when they stretch the antennas out according to the instructions. I never experienced the range problems with the original modular Spektrum system that others reported... I always got more than enough range for typical racing situations with the std antenna fully enclosed inside the pot of the Disco.

"There is one point that I think some skippers may have trouble with. If you hear of any skippers not getting the range that they would like then ask them if they are pointing the tx antenna at the boat. It is very important to bend the tx antenna upright. Try this yourself. Point the tx antenna straight at the boat and see how much less range you get. I suspect that in some cases it was incorrect tx antenna orientation that was giving grief to skippers with the original system. They may well have not needed the rx extension."

AMYA Membership Form

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This application is for (circle one): **NEW MEMBERSHIP** _____ **RENEWAL** _____

If renewal, please enter your membership number, if known: _____

Contact Information: Please enter your contact information. This information will never be sold for commercial purposes.

NAME _____

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Type of Membership: Membership in the AMYA is open to anyone who shares the goals of the organization. Adult membership includes four issues of Model Yachting, eligibility for registration in AMYA classes, eligibility for entry into AMYA championship events, and one vote in the affairs of the organization and classes, and other benefits. Junior membership is available to applicant under 19 years of age, but is otherwise identical to an Adult membership. Family membership provides a single Adult membership and eligibility in AMYA championship events for all family members the same household.

ADULT	25.00	<input type="checkbox"/>	Membership
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