
# A CALL TO ARMS!!!

***MODEL FLYING WORLD***

You will have received your April MFW last week, and noticed that instead of being the usual 56 pages, there was only 48!

This was because there was nothing available to print on the missing 8 pages!!!

The editor has had a small collection of articles in reserve, for such an occurrence, but everything had been used. The President and Secretary were able to gather some material, and our thanks to those who rose to the challenge and provided copy at very short notice.

We do not want to produce another 48 page (or even 40 page) MFW for the June, so copy will be needed.

The deadlines are always on Page 2 of the magazine.

The cut off for the JUNE edition is 1 MAY, which is **15 days away!!!!**

**Murray Race the editor is producing an outstanding magazine, but cannot do it alone. The members must provide the articles. Some articles are time sensitive, others can be used any time. Both are required.**

**Over to you**

**Dave**

Dave Wright

Secretary

MFNZ

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# CLUB CAPTAIN

Open Day was another successful day not as many flyers as other years the pits weren't overcrowded and a good number of spectators. A bit of moisture fell out of the sky at the end of the day when we having a beer the weather hasn't been good since, we were lucky with our day.
Thanks to all that helped set up on Saturday and clean up after on Sunday.
Many hands make light work.

A great display was put on by Hamish, Tarquin and Peter with their Jets, Renee with his Cresco and Wayne`s Pawney topdressing, Steve 3D with his Sbach and Anthony doing acrobatics with his Nuance.

Anthony Hall is going to Thailand in May to represent New Zealand in the Asia Oceanic Aerobatic Championships. All the best from all of us at Aeroneers.

**Aerobatic fanatic**


**Flying fit:** Anthony Hall from Palmerston North demonstrates his Nuance Aerobatic model aeroplane at an open day at Colyton featuring dozens of miniature jets, warbirds and gliders. Hall will be one of three New Zealand representatives travelling to Thailand in May for the Asia Oceanic Aerobatic Championships.
Photo: GRANT MATTHEW/FAIRFAX

Club Captain
Bruce Fryer

Some weather sites to check before you fly:

http://www.metvuw.com/forecast/forecast.php?type=rain&region=nzni&noofdays=7

http://www.metservice.com/towns-cities/palmerston-north

http://weather.niwa.co.nz/Palmerston_North

http://www.feildingweather.com/gauges-ss.php

http://www.wunderground.com/cgi-bin/findweather/hdfForecast?query=-40.225%2C175.567&sp=IMANAWAT15

You've got to see this one. These are flights which took place over a period of 24 hours over Europe from actual flight data (speeded up)

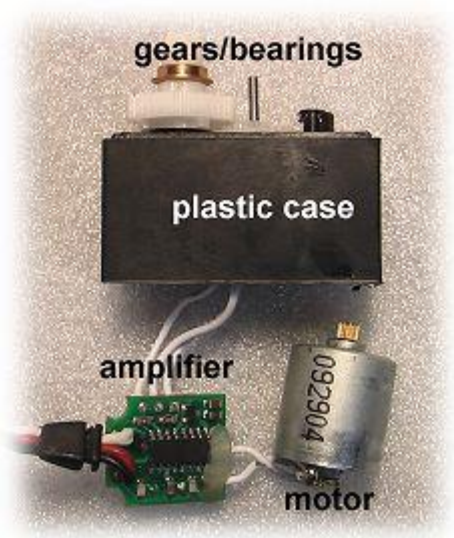
http://nats.aero/blog/2014/03/europe-24-air-traffic-data-visualisation/

# How do RC Servos Work?

THE BASICS OF RC SERVO OPERATION


RC servos come in an amazing range of sizes, speeds, strengths, weights, shapes colours and varieties but they all work on the same basic principles.

The job of an RC servo is to position its output arm to a position that exactly corresponds with the movement of the corresponding stick, switch or slider on the transmitter. What's more, it should do this as quickly as possible and provide a high level of accuracy regardless of the effects of aerodynamic loads or other factors.




Most servos, regardless of brand or type, consist of several main parts:

- **The mechanics**. These are the gears and the case.
- **The motor**. This provides the motive force to drive the output arm
- **The feedback pot**. This allows the servo to measure the actual position of the output arm
- **The amplifier**. This is the electronics that hook all those other bits together to make it work

Now let's take a look at those bits in more detail...

**The Mechanics**

Most RC servos have a plastic case, the top section of which contains a set of gears that can be either plastic or metal. The strength and rigidity of these mechanics play a significant role in determining the robustness and weight of the servo, with metal gears usually being significantly stronger (and heavier) than plastic.

The choice of gear material depends very much on the type and size of model in which the servo will be used. Generally speaking, plastic gears are only suited to models up to 5-6 lbs in weight.

**Bearings**

The output shaft and gear of a servo experiences significant side-loading during its operation and this means it needs some kind of support to stop it from moving out of mesh with the rest of the gears.

Cheap servos tend to simply rely on the plastic shaft rubbing against the plastic of the case and for small/slow models this isn't too much of a problem. These servos are often caleed 'bushed" and, because there has to be some clearance between the shaft and the case, usually demonstrate some side-to-side slop in the output shaft, which can appear as a degree of rocking up and down of the output arm.

However, precision and hi-torque servos really do benefit from the addition of a ball-bearing or two on the output shaft. This significantly reduces the friction, virtually eliminates wear and means there should be no slop at all in the output shaft.

Good servos have a single bearing (usually in the top of the case) while even better servos have two bearings -- one in the case and one at the bottom of the output shaft.

**The Motor**

There are basically three different types of motors used in model servos, the most common of which is a brushed motor with three or five-pole armature. The benefit of these motors is their low cost and robustness. The downside is that, because of their heavy iron armature, they tend to respond more slowly.


The second most common type is the coreless motor which, as the name suggests, does not have an iron-cored armature but instead has a lightweight plastic armature on which the field windings are formed. This has the advantage of being able to start and stop far more quickly (due to its low mass) and also produce more torque -- since the diameter of the windings is much greater than with a cored motor.

Because they cost more to manufacture, coreless motors are usually only found in expensive servos designed for very fast transit times (such as used on heli tailrotors).

The final motor type is the brushless variety being offered in just a few servo models from big-names like Futaba. The brushless motor can be designed to provide very high levels of torque and has no brushes to wear out. Servos with brushless motors are few and far-between right now though because of the costs involved.

# 2.4GHz Radio Control Explained

## JUST HOW DOES SPREAD SPECTRUM RC REALLY WORK?

If you've got, or you've been thinking of buying, a 2.4GHz spread-spectrum RC set then you'll probably be keen to understand exactly how it works, and hopefully this article will help you do so.

**First, a few words about older "narrowband" RC systems...**

Traditional narrow-band RC systems on anywhere from 27MHz to 72MHz are fairly easy to understand because they work just like your regular AM or FM radio - sending out a signal that is picked up by the receiver and then sent to the servos.

Unfortunately, just like regular FM broadcast radio, these RC systems require a frequency all to themselves if they're going to avoid interference with each other. What's more, it doesn't take much to disrupt a regular narrow-band signal. A noisy thermostat or electric drill can often cause massive amounts of electrical interference when listening to an AM broadcast and FM isn't always that much better.

But manufacturers of spread spectrum (SS) radio systems are claiming that you need never worry about being shot down by other fliers and that all 2.4GHz systems can get along in harmony, despite apparently using the same frequencies.

So how can that work?

Well to explain this, I'm going to use a series of illustrations that I call "the freeway analogy". Using these diagrams and explanations, I will do my best to convey the complex world of spread spectrum in a form that most people can get their brains around. Of course in doing this I've had to take a few liberties with the details but these are not important.

**Which Flavour of Spread Spectrum?**

YES, IT COMES IN DIFFERENT FLAVORS

Before I launch headlong into a detailed explanation, it's worth pointing out that there is more than one flavour of spread-spectrum.

The first and most common type is what we call **Direct Sequence Spread Spectrum** (DSSS). This involves the transmitter and receiver staying within a fixed part of the 2.4GHz spectrum.

The second type is called **Frequency Hopping Spread Spectrum** (FHSS) and involves having the transmitter and receiver constantly changing their operating frequency within the alowed limits of the 2.4GHz band.

At the present time, only Futaba and Airtronics use FHSS, the remainder using DSSS.

And right now I can year you asking *"which flavor is best?"*... to which I have to say... neither and both.

Or, in other words, neither solution is best all the time, there are benefits nor drawbacks to both, as you will see. However, it's safe to say that in theory, the Futaba FASST system does give the best of both worlds because it is not only FHSS but also DSSS.

But first, let's see how a traditional "narrowband" FM RC set works on frequencies such as 27, 35, 36, 40, 41 or 72MHz.

**Distributed Spread Spectrum (DSS)**

SPREAD SPECTRUM EXPLAINED


Distributed Spread Spectrum radio can be likened to a multi-lane freeway where your car seems to appear at random in different lanes. In fact, it appears and disappears so quickly that it almost appears to exist in all lanes at the same time.

In radio terms, the transmitter uses a wide spread of frequencies to send data to the receiver, rather than the very narrow band of frequencies used by the older narrowband RC sets we've seen up until now.

**So what's the point in spreading yourself so thinly?**

Well if you stop and think about it, if your "DSS" car encounters another on the freeway, it won't have very much effect. Your own vehicle won't be blocked because it will simply continue past when it suddenly appears in another lane which isn't blocked.

In radio terms, a single (or even quite a few) other transmissions won't have much effect on your RC system because they'll only block a tiny amount of the signal being sent. In fact, unless the freeway is almost completely blocked, at least some of the signal from your transmitter will get through to deliver your control inputs to the receiver.

Even better, if another DSS transmitter (or even several more) is operating on the same channel, it is also unlikely to interfere because it'll be jumping lanes in a different sequence and at a different rate.

So in a DSSS system, the last SS stands for Spread Spectrum and the first two letters stand for Direct Sequence. This relates to the order and frequency at which your vehicle moves between the lanes.

***How DSSS Handles Interference***

THE BATTLEFIELD ANALOGY

Another way to help you understand how a DSSS system avoids being "shot down" by interference is the battle-field analogy.

When an army goes into the modern battlefield, they're usually ordered to "spread out" -- and that's exactly what DSSS does, it spreads your transmitter's signal out over a much wider area than is the case with FM/PCM gear.

Just as on the battlefield, it's much harder to kill an enemy when they're spread over a wide front, so it is with a DSSS radio signal.

The chances of any single rifle-shot actually hitting a soldier on the battlefield is significantly reduced when they're widely spaced across the whole front. With DSSS, your radio signal is similarly spread very thinly across the radio spectrum and thus virtually immune to enemy fire, unless that fire is very intense.

By comparison, a closely grouped army of men can be decimated in moments by a single mortar shell or burst of machine-gun fire. That would be the equivalent of your old RC gear being shot down by interference or another transmitter on the same frequency being turned on while you're flying.

So what if someone turns on another DSSS system that uses the same channel you're already on?

Well because DSSS spreads your troops so thinly across the battlefield, there's plenty of room for another platoon from a totally different army to run between the ranks without the two colliding. This is why multiple DSSS systems can co-exist on the same channel without interfering.

***Which radios use DSSS***

Of the currently available 2.4GHz spread spectrum systems, all use some form of DSSS but others, such as the Spektrum/JR and Futaba FASST systems use other techniques to offer even greater protection from interference.

Several other systems that have gained a small following are those from XPS, Assan and iMax. These also use DSSS but appear to have no effective way of coping with the kind of crippling interference that might leave the other systems unaffected.

**How do FHSS RC systems work?**

FREQUENCY HOPPING SPREAD SPECTRUM


Frequency Hopping Spread Spectrum radio systems work by constantly hopping between a number of frequencies.

If you've just read the description of how DSSS systems work you're probably wondering "what's the difference?"

Well, whereas the DSSS system is like a car that repeatedly appears and disappears on various lanes of a freeway, at such a rate that it almost appears to be everywhere at once, a FHSS system effectively sees your car not simply jumping a small distance to a nearby lane, but all the way to a completely new freeway.

In radio terms, this means that the frequency sent by the transmitter doesn't just jump around within the chosen operating channel but actually jumps between a whole range of different channels.

It can be seen that, at least in theory, the FHSS system should be even more immune to the type of congestion that would cause problems with a DSSS system. That's because although nothing may get through while it was using a very congested freeway, the hop to a less congested one would allow the normal transfer of data to resume.

Under normal circumstances a FHSS system hops between a fixed number of channels in a repeating random sequence. When multiple FHSS systems are used together, the random nature of the hopping sequence means it's very unlikely you'll find multiple sets trying to use the same channel (freeway) at the same time.

***How FHSSS Handles Interference***

THE BATTLEFIELD ANALOGY

In a pure FHSS system, the troops are all closely grouped together as was the case with an old narrowband system but, because they're constantly jumping from battle-field to battle-field, the effect of enemy fire in any particular field is minimal.

Imagine that the whole army is teleported onto a battle-field and then, before you realise it, telported away to another. Clearly this makes a FHSS system a hard target for interference to hit.

However, the FHSS systems we're seeing used in radio control systems right now are a blend of both DSSS and FHSS. This means that not only is the signal spread across a whole channel but it also hops continuously from one channel to another.

This means that an FHSS system is an incredibly difficult target for any interference to hit -- and when you're flying RC models, that's a very good thing.

**Belt and braces**

EVEN MORE PROTECTION AGAINST INTERFERENCE

By now you've probably realised that spread spectrum technology offers some very clever ways to reduce the effects of interference and allow many different radio sets to operate simultaneously without the need for a frequency peg.

Thanks to the way these systems spread their signals thinly across the 2.4GHz band and thanks to the way some of them hop around so as to remain a moving target, it takes a very strong interfering signal to have any effect.

I've already explained that, at least in theory, the Futaba FASST system is probably the most bullet-proof SS system on the market, but the JR/Spectrum offering has also made itself doubly resistant to interference -- not by hopping all over the place but by adding a redundant channel.

As previously outlined, a DSSS system *can* be knocked out if the strength of an interfering signal on that channel is strong enough -- so JR/Spektrum reduces the risks by using two channels at once.

This means that even if a very strong interfering signal appears on a channel being used by your JR/Spektrum set, you won't lose control, and that's because the second channel on its different frequency will almost certainly be unaffected.

Reputable manufacturers realize that their systems may be in control of very large, expensive and potentially dangerous models so they try to allow for as many contingencies as possible. Futaba uses constant frequency hopping, JR/Spektrum uses a backup channel (a tactic known as redundancy).

***What is diversity?***

Another important aspect of 2.4GHz spread spectrum radio control systems is something called diversity.

Diversity is required because the radio signals at 2.4GHz behave quite differently to those we're used to on lower frequencies such as 72MHz.

Whereas the old narrowband frequencies will pass right through most objects such as houses, trees, fences, and model airplanes, 2.4GHz behaves much more like light, being either absorbed or reflected by many parts of the environment.

This absorbing and reflecting of the 2.4GHz signal results in occasions when the receiver antenna by be shielded by some part of the model, or may even be subject to the kind of ghosting that used to be seen on old TV sets when the signal was reflected by trees or buildings (called multi-pathing).

The effects of shielding and/or multi-pathing mean that it's quite possible the receiver will be unable to hear the transmitter clearly enough to extract the data being sent.

The simplest (and best) solution to this problem is to use more than one antenna and/or more than one receiver in your model. By mounting these antennas or receivers in different places (even just an inch or two a part), one can take over if the other is unable to get a clear signal.

The JR/Spectrum system allows for multiple receivers, up to four or more and some of these receivers have multiple antennas. This is surely the ultimate diversity setup. On very large models, you can be absolutely sure that there's no chance of shielding or multi-pathing by simply increasing the number and distribution of receivers within the plane.

The Futaba FASST system uses two antennas mounted on the one receiver. In theory this isn't as good as the JR/Spektrum option but in practice it seems to work perfectly adequately.

# PRESIDENTIAL PONDERINGS

My report this month is all about Thank you's.

Firstly, to Richard Manderson for his contribution to the Committee and Club. Richard has indicated that he will take 12 months off and we may see him back for another stint.

A special thanks from the Club to Bruce Withell for his long service as Club Treasurer. Bruce is still on the Committee and his knowledge is very valuable. I am sure that Nigel Langford will do a great job in the Treasurer's seat. The Club has purchased a laptop computer to hold all money matters on it.

Our Open Day was another great event and my thanks go out to all who took part. It's great to see Committee and Club members (and wives) work so well to make the day run smoothly. The National Body were great in sending us the sound system, hand-out books and banners. This all helped our expenses on the day.

Let's hope that the rest of the year allows us plenty of flying days. This summer has not been too kind.

My final thank you is to John Martin who has been so good to the Club. The dry weather has affected him this year and I hope that the rain comes soon to make his farm blossom again.

Don't forget the Indoor flying!

Peter Vining

**President**

April 2014

# COMMITTEE REPORT

## Club Events

Check: http://www.aeroneers.com/apps/calendar/

April 2014

24th NO Club Night - ANZAC day tomorrow!

25th ANZAC day

27th Tomboy & Vintage

May 2014

1st May Committee Meeting

4th Glider 2m

11th Tomboy & Vintage

13th Indoor Flying

18th Combat – SPAD & Assassin

25th Cub, Sport & Scale

# Club Subs

Family $140.00
Senior $135.00

Junior (under 18) $40.00
Associate $40.00
Associate (Flying) $80.00

Subs are per annum. Please pay to Bruce Withell (Treasurer) or any Committee Member.

The club needs to pay the Insurance Fees to the NZMAA prior to July 1st to ensure all Club Members are covered by the MFNZ Public Liability Insurance.

**You need to be a paid member to fly at the Club Airfields!**

**Dates to remember for 2014**

- Indoor Flying being booked for one Tuesday per month April through October
  - May 13th
  - July 1st
  - July 29th
  - August 19th
  - September 9th
  - October 14th

Model Flying NZ Up and Coming Events NDC 2014 Calendar

# CLUB DETAILS

Opinions expressed in this publication are those of each contributor only.
The Editor and Committee reserve all right in respect of submitted material.
Contributors are reminded that the deadline for publication is the 18th of each month.

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