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SANDERSON FIELD R.C. FLYERS
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SANDERSON FIELD R.C. NEWS

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CLUB MEETING

This months meeting will be held on Thursday May 12th at 7:00 p.m.

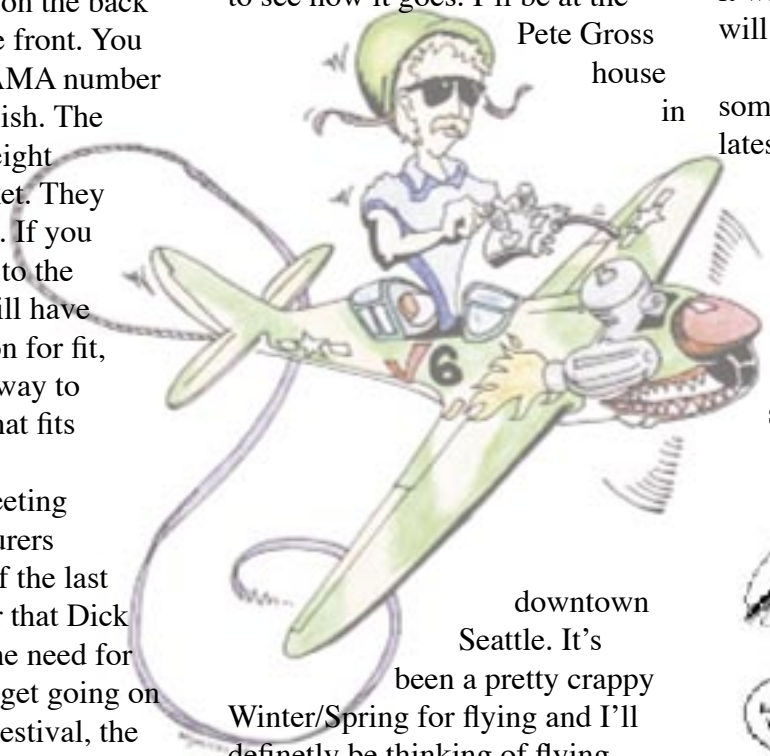
at PUD #3

At 3rd & Cota

We are in the process of getting some club jackets made with a big club logo on the back and first name on the front. You can also have your AMA number on the front if you wish. The Jackets are a lightweight Spring/Summer jacket. They will cost around $80. If you are interested, come to the May meeting. We will have various sizes to try on for fit, this will be the best way to insure you get one that fits you.

The April meeting consisted of a Treasurers report and a report of the last board meeting. After that Dick Robb talked about the need for the float comittee to get going on the float for Forest Festival, the continuing search for information on possible radio frequency conflicts, the April 23rd swap meet and we also had a couple of show and tells. Bob Andrew brought his twin and Bob Beatty brought his P-47.

I'd like to make it to the swap meet but as I will be undergoing a stemcell transplant for the next couple of months I won't be around for a while. I'm going to try to continue the news letter while I'm gone (I'll be living in Seattle for about 2 months) but we'll just have to see how it goes. I'll be at the Pete Gross house in downtown Seattle. It's been a pretty crappy Winter/Spring for flying and I'll definetly be thinking of flying while I'm gone.



I'd like to remind everyone that I'm always looking for articles for the newsletter. I'm especially looking for other types of info other than the stuff I've been doing so if you haven't seen the kind of info you'd like in the newsletter let me know and I'll do my best to find it. It would be great if YOU could find some thing and send it to me.

I found an interesting article on radio interference and with our current probing of the radio waves looking for "interference" I thought it was timely. It's fairly long so it will be in a couple of installments.

I really thought at least some of you would like to see you latest projects in the newsletter but I didn't get a single response to the plane of the month last month. I did coerce Bob Andrew into sending a picture of his Twin but I'll drop the idea next month if no one sends any pictures.

Radio Interference Primer for R/C Flyers

By Max Feil, Oct 2/1992

In the increasingly popular hobby of radio controlled model airplane flying, frequency congestion has prompted a series of changes over the years to allow more flyers to use the same frequency band. Today's dense frequency environment demands that extra precautions be taken to avoid interference problems, which in R/C flying can result not only in the loss of prized aircraft but personal injury or property damage as well.

I will attempt to explain in my own words the issues involved in trying to minimize both congestion and interference problems. I will start with some simple theory, and then apply this to the five main interference problems that can result with radio equipment that is in use today. The goal of this article is to stimulate discussion and increase understanding to allow the members of R/C clubs to update and improve their frequency rules to help provide a safe and enjoyable flying site.

Theory: Adjacent channel energy & IF; intermodulation.

First, some very general, oversimplified theory on radio interference causes. Keep in mind that I am not an RF engineer. I am also trying to keep things as simple as possible for the average R/C modeler. If anybody wants some more detailed, technical information, I have a very good article sent to me by somebody who works in the radio industry that I can pass on to you.

When we talk about the frequency that an R/C radio system operates on, we really mean its "center frequency", since both the transmitter and receiver operate within a band of frequencies that is several kilohertz (kHz) wide. Your transmitter will transmit strongest at frequencies very close to its center frequency, with a decrease in signal strength as you move away from the center frequency. Similarly the receiver will be most sensitive to frequencies very close to its center frequency, with a decrease in sensitivity as you move away from the center frequency. Note that the center frequency of the receiver can be slightly different than the center frequency of the transmitter and things will still seem to work ok, but since power decreases as you move out from the center frequency, range will be reduced. Incidentally, this is why range checks are important. A bad range check may indicate that either the transmitter or receiver are out of tune and their center frequencies no longer line up. A crystal change can produce the same effect. The radio must be fine tuned afterwards to ensure that the transmitter and receiver are centered correctly, both with respect to each other and with respect to other radios.

The width of this band of frequencies around the center frequency is a major factor in determining the effects of radio interference. If your receiver encounters a second signal that is too close to its center frequency and the two bandwidths end up overlapping too much, then interference will result. The closer the interfering signal is to the receiver's center frequency, the less power is needed to cause interference. In the extreme case, if somebody turns on their transmitter and is on exactly the same frequency as you, you may crash even if their signal is very weak, for example if their antenna is down or if they are flying several kilometers away. Conversely, if somebody is operating on a frequency that is quite far away from the center frequency of your receiver, they can still interfere if their signal is strong enough. I will come back to this point later.

If this was the only way that interference could result, life would be simple. However there are several other RF interference mechanisms and they are much less obvious.

Pretty well all receivers convert the signals they receive to lower "intermediate" frequencies through the use of one or more special internally generated frequencies. The principle is called "heterodyning" and it involves mixing the received signal with locally generated frequencies in one or more stages. Receivers with one stage are called "single conversion" and almost always use

Radio Interference (Continued)

an intermediate frequency (IF) of 455 kHz. Receivers with two stages are called "dual conversion" and usually use a first IF of 10.7 MHz and a second IF of 455 kHz. It is in the mixing process that several problems may be introduced which can result in unwanted signals showing up after conversion to the intermediate frequency. There are two main concepts here: "image frequency" and "distortion".

Each conversion stage in a receiver will have an image frequency. It will convert not only the desired signal down to the intermediate frequency, but also any signal that is twice the IF either above or below the desired signal, depending on the type of conversion being used (high side or low side). For example, if you are using a single conversion receiver, the image frequency will be 910 kHz (45.5 channels) away, either up or down (but not both). If another transmitter in the R/C band is operating at this frequency, you may experience interference. Note that image frequencies are not a problem for dual conversion receivers since at each stage they are far away from the desired signal and therefore easily filtered out beforehand.

The signal mixers that are used to perform frequency conversion in the receiver also introduce a certain amount of distortion. This results in the creation of extra frequencies called "harmonics" and "intermodulation products". Harmonics are simply signals at multiples of the desired or "fundamental" frequency. This is similar to what happens when you hit a piano key or pluck a guitar string. For example, if a radio frequency of 72.030 MHz is present, then distortion will create harmonics at 144.060 MHz (2 x fundamental), 216.090 MHz (3 x fundamental), etc. The power of each successive harmonic (2nd, 3rd, 4th, etc) is generally lower than the previous one. Luckily, harmonics are so far away from desired signals that they are easy to filter out. Intermodulation, on the other hand, is perhaps the most important concept of this article. It takes place when more than one radio frequency is present, and is defined as the production of sum and difference frequencies from the set of original frequencies present. For example, if two frequencies f1 and f2 are present, they will "intermodulate" and produce two additional frequencies f2 minus f1 and f1 plus f2. These are called the 2nd order intermodulation products (2IM).

To help illustrate this, I will point out an effect similar to intermodulation that is noticeable in everyday life. When two tuning forks of almost the same frequency are struck at the same time, a slow pulsating "beat frequency" is created which is quite audible. This is the difference frequency you are hearing. Anybody who plays guitar will also recognize that difference frequencies play a big part in being able to tune their instrument. Now let's go further and note that the 2nd order intermodulation (2IM) products combine further with the original frequencies to again create sum and difference frequencies that are the 3rd order intermodulation products (3IM). Luckily, with each successive order of intermodulation (2nd, 3rd, 4th, etc) the power of the signal decreases. As an example, consider two people flying, one on channel 44 (72.670 MHz) the other

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Radio Interference (Continued)

on channel 40 (72.590 MHz). The sum and difference frequencies created are 145.260 MHz and 80 kHz respectively. These are the 2IM frequencies, of which 80 kHz is the more important one. The 80 kHz signal recombines with the two original frequencies to produce new signals with frequencies of 72.590 - 80 = 72.510 MHz and 72.670 + 80 = 72.750 MHz. These are 3IM products, and note that they correspond to channels 36 and 48! They are usually not a big problem since the power of third order products is quite low. Also, newer receivers are quite good at keeping intermodulation products generated within themselves to a minimum.

Note that not all intermodulation products are created inside the receiver. Some intermodulation products are actually created within transmitters that are operated too close together. Transmitters will generate significant levels of intermodulation if they are closer than about 20 feet together.

So, now we have talked about the sources of interference for a receiver, namely a signal being too close to either the main frequency or the image frequency, and we have also talked about how various (perhaps unexpected) frequencies are generated both by transmitters and within the receiver through intermodulation distortion.

Radio systems: old frequencies; recent pre-1991 radios; 1991 radios: single conversion, dual conversion, JR's ABC&W.

To lead up to a discussion of specific problems that need to be addressed at today's R/C flying field, I will start with a brief history of radios and radio frequencies in use in Canada and the U.S. I will concentrate on just the 72 MHz band, and ignore the 27 MHz (CB) band, the 50/53 MHz ham frequencies, and the 75 MHz surface frequencies.

In the past, the R/C spectrum was not as crowded as it is today. Most R/C activity was restricted to an original set of 6 frequencies which were specified not using channel numbers, but by using a two-colour flag system. Purple/white was 72.320 MHz, red/white was 72.240 MHz, etc. These channels were no closer than 80 kHz together, and the original radios were designed around this 80 kHz spacing and used single conversion receivers. In fact, in Canada many of these radios are still in use today, which is why many Canadian R/C clubs, including the Stetson Flyers and the Ottawa Remote Control Club, still follow 80 kHz spacing rules on their frequency boards through the use of a 5-pin wide system.

If you haven't paid your dues yet it's after January 1st now and Dues are $40.

If you pay by mail send your dues, proof of 2005 AMA membership and a self addressed stamped envelope to the Treasurer:

Chuck Kentfield
6843 Gallagher Cove Rd NW
Olympia WA 98502

The next step, which took effect in 1988, was the establishment of 50 R/C channels, all 20 kHz apart, starting at channel 11 (72.010 MHz) and running to channel 60 (72.990 MHz). Note that the 6 old frequencies fall "in-between" these channels, and therefore are sometimes referred to as "channel 26 and a half" or "channel 22 and a half", etc. At first only even channel numbers were available, with odd channels slated for introduction in 1991. This meant a minimum possible spacing of 40 kHz.

Most flying fields still kept to the old 80 kHz spacing, especially in Canada where the original 6 frequencies were still in use. This meant that two people could fly only if they were at least 4 channels apart. This was the intent anyways, but due to non-linearities in the official MAAC (Model Aeronautics Association of Canada) frequency board, the 5-pin system actually restricted flyers to 120 kHz spacing between channels 32 and 46, and between channels 54 and 58. This was an unnecessary restriction and led to unneeded congestion which continues to this day.

(This article will be continued next month)

"Inside every older person is a younger person wondering what happened".

PLANE OF THE MONTH

THE UGLY TWIN

The Ugly Twin was introduced into the RCM Plan Guild catalog in 1975, plan #584.

I first observed this plane in Canada at the Shuswap Lake system while attending their float fly somewhere around '90 or '91.

Gordon Parr, a friend of mine, had modeled it after the plans and put it on floats. This thing flew great. It was something different.

The would-be modeler that I am I just had to have one as well as a good friend of mine, Dick Robb, but we just couldn't leave well enough alone. You know just small changes! So we changed the fuselage, the tail surfaces, the nacelles, put cowls on it, changed the float mounting system, put wheel pants on it, and of course put bigger power plants on it. The only thing we didn't change was the flying moments. Well wait a minute, that got changed too.

It weighs in at 11 pounds and is powered by twin OS61's. The radio system is by Futaba.

Dick's twin will be finished sometime this month, and again somewhat different than mine. That is the fun of this hobby!

By the way they still fly great with all the changes!

by Bob Andrew

BELOW ARE THE SCHEDULED EVENTS FOR 2005

Club Scheduled Events for 2005

January.....Annual 1st fly of the year
February .....
March .....
April 23rd .....Sanderson Field RC flyers annual swap meet 9:00 to 12:00 SHS Sub
May .....
June 11th .....Display at Walmart
June 12th.....Public Fly-In
July 9th.....fly-in 9:00 a.m. to ?????
August 20th.....Scale fly-in 9:00 a.m. to ????
September 10th.....Fly-In 9:00 a.m. to ????
October .....
November.....
December .....

It's time for 2005 dues, *pay before December 31st for $10 savings*

Check out our web site at http://sfrcf.quintex.com