Bergen County Silent Flyers

http://www.geocities.com/silentflyers/
Summer 2002

Edited by Dan Roman

Summer Flying

Our regular Thursday evening flying sessions have been very well attended. You will usually find us there from 5 PM until dark. They have been so well attended in fact, and there are so many planes in the air, that the club officers have come up with some new guidelines. You can find them in this newsletter.

The large turnouts have also prompted us to get more organized with regard to frequency coordination. Look for a new frequency pin pole to be appearing at the field soon and please prepare a clothes-pin or clip with your channel number and name on it for use with the new pole.

The frequency pin pole should help with one type of transmitter interference, but read the article on interference for ways to limit several other interference sources. Not all interference can be eliminated or predicted, but some can be reduced and knowing a few simple rules of thumb can help prevent disaster.

Finally, the **Northeast Aircraft Technology Fair** is coming up fast, September 13-15. Held at Peaceful Valley in the Catskill's in lower NY State, NEAT is the nations largest gathering of electric model aircraft. The club will again have a tent set up for club member's use throughout the fair. Dinner will be provided for club members at the tent on Saturday evening. There will also be informal lectures and demonstrations by technology designers or building technique craftsman at our tent during the event. See the bulletin board in front of the tent for events and times. If you have a topic or demonstration you'd like to present talk to Sergio. Details on NEAT as well as directions can be found on the NEAT web site at www.neatfair.org.

New Guidelines

We are most likely one of the least complicated Model Airplane clubs in the country. We want our members to have fun and not worry much about rules and regulations. Just common sense will do. We only interfere when things get out of hand and we believe this is the case right now. Members have been complaining of being afraid to fly their delicate slow flyers and we've seen some reckless flying.

Zagi style combat and dangerous flying close to the spectators is an accident waiting to happen. After more that 15 years of enjoying our flying park we don't want to lose it. Below are some basic guidelines the club proposes.

1. If you are not a BCSF member, become a member. Unless you are a member, you are not covered for this particular field, even though you are an AMA member. Our Bergen County permit to fly in this park only applies to BCSF members (dues are only $10).
2. No flying or landing close to or toward the members/spectators, especially with the fast planes.
3. If you are sponsored by a member, that member should notify other members at the field if the president and vice-president are not present. The sponsor must be fully responsible for his guest.
4. Zagi style (Razors, flying wings, etc.) combats will be allowed only the first 10 minutes on the half-hour. The planes flying combat must be flown away from the spectators (beyond the line of the bush on the right side, about 40-50 feet way from the spectators). One of the club members will be doing the time checking every Thursday or other club-flying day. The other 20 minutes on the half-hour will be for open flying. You can still fly your Zagis and Razors at all other times, but please no combat flying and give the slower planes a wide berth.
5. We are open to any other suggestions.

Please direct your comments to the president, Sergio Zigras or vice-president, Ben Bendit (temporarily recovering from a bypass operation).

Radio Interference

There are many possible sources of radio interference at a flying field like ours. Business band radios, pagers, and out of spec transmitters can cause a temporary loss of control. Most of us think these types of interference problems are the most common and that we understand all there is to know about interference. The only mitigation we have for outside interference is avoidance.

This article is not about outside sources of noise that are out of our control, but rather how our own transmitters and receivers can also cause interference problems. If we understand how these interference mechanisms work we can avoid unfortunate accidents that may be within our own control.

The frequency at which an RC radio transmitter and receiver operate is really referring to its center frequency. The actual width of the signal is several kilohertz wide with the strongest part of the signal at the center frequency. The signal decreases in strength as you move away from the center frequency.

For example, channel 40 is at 72.59 MHz, which means that it will have appreciable radio frequency energy several kilohertz on either side of 72.59 MHz. Depending on the transmitter, it may have significant signal strength from 72.585 to 72.595 MHz. In this example, the transmitter would have 10 KHz bandwidth. Exactly how much energy is determined to be significant is expressed in dB down from the peak at the center frequency (and therefore the bandwidth).

If the center frequency between the transmitter and receiver are slightly different, the receiver will still be able to get a usable signal from the transmitter but the range will be reduced since the power level drops as you move away from the center frequency. This reduced signal strength will make the receiver more susceptible to interference. A bad range check may indicate that the transmitter and/or receiver need to be aligned closer to their intended center frequency. In fact, any condition that reduces signal strength like a bad antenna or weak battery will increase susceptibility to interference.

The worst-case situation for interference is when someone else turns on a transmitter on the same channel you are using. Frequency coordination is the key for prevention in this case.

A poorly aligned transmitter on an adjacent channel can cause interference as well. If a receiver encounters another signal too close to its center frequency and the bandwidths of the bad transmitter on the adjacent channel and the receiver overlap by too much, then interference will occur. If a transmitter or receiver is more then 1.5 KHz off its center frequency, it should be realigned by the manufacturer.

Current RC frequencies are on 20 KHz spacing. This permits a bandwidth of +/-10 KHz for all channels. Very old radios (using the two-color flag system on six frequencies) operated on 80 KHz spacing. Pre-1991 radios operated with 40 KHz spacing (all the even channels). In 1991, the rules changed and all radios had to operate with 20 KHz spacing giving us our present day 50 channels. No one should be using old radios, it is just asking for interference problems. A pre-1991 radio could interfere with or be interfered by radios a channel or more away on either side. The gold sticker campaign that took place was intended to verify if a transmitter was narrow-band enough to prevent interfering with someone else's receiver on an adjacent channel. Receivers were not gold stickered however. If your receiver was not narrow-band, it could still be interfered with by a legal transmitter on an adjacent channel! Old radios are not worth the risk to your model or everyone else's and should not be used. The 20 KHz spacing system only works if both the transmitters and receivers for all radios in use are narrow-band. To play it safe you may not want to fly if someone is using a frequency only one channel away.

All receivers convert signals they receive to lower intermediate frequencies (IF) by using internally generated frequencies. This is done in one or more stages. Receivers with a single stage (single conversion) use an IF of 455 KHz. Receivers with two stages (dual conversion) use an IF of 10.9 MHz in the first stage and 455 KHz in the second stage. Note: These are the most common IFs.

Each stage in the receiver will have an "image frequency" (not to be confused with the IF). Not only is the desired frequency converted down to the IF but also any signal that is twice the IF either above or below (not both) of the desired frequency. Therefore, if you are using a single conversion receiver the image frequency will be twice 455 KHz or 910 KHz either up or down from the center operating frequency. If another transmitter is operating near this frequency, you may experience a problem because the image frequency signal is so close to the desired signal it cannot be filtered out (especially since most receivers are designed to work in the whole RC aircraft band just by changing a crystal so other frequencies in the RC aircraft band cannot be filtered). For example, if you are operating on channel 60 with a single conversion receiver that has an image frequency 910 KHz below its operating frequency you could be interfered with by a transmitter on channels 14 or 15. If you are using a single conversion receiver, don't operate if someone else is 45 or 46 channels away. Dual conversion receivers do not have this problem because the first stage IF is 10.9 MHz, which puts the image frequency well outside of the aircraft RC band which means the image frequency can be very effectively filtered out.

The frequency conversion in the receiver discussed above is performed with signal mixers. This causes extra frequencies to be generated called harmonics and inter-modulation products. Harmonics are simply multiples of the operating frequency, otherwise known as the fundamental. The first harmonic is the fundamental frequency; the second harmonic is two times the fundamental, etc. A radio operating on channel 40 has a fundamental frequency of 72.59 MHz and a second harmonic of 145.18 MHz. The power of these successive harmonics drops off rapidly due to the physics of RF and the filtering on the transmitter outputs. Harmonics are not a problem for us because they are well outside the RC aircraft band.

Inter-modulation though can be a problem for us and has accidentally been demonstrated at the flying field on at least one occasion (August 1). Inter-modulation takes place when more than one frequency is present. It is the sum and the difference of the frequencies present. Two frequencies will "inter-modulate" and produce two new frequencies. These frequencies then interact with the original two creating even more inter-modulation frequencies. Fortunately, each order inter-modulation product (2^{nd}, 3^{rd}, etc.) rapidly gets weaker. These inter-modulation products can affect us in two ways.

For the first example, suppose two people are flying on channels 460 KHz apart, say channels 17 and 40. This second order inter-modulation product is close to the 455 KHz IF and could affect any single conversion receiver in the air, especially if the two transmitters are physically near each other and the plane flies in their immediate vicinity. To avoid interference to single conversion receivers, transmitters should not operate 23 channels (460 KHz) apart. Note that double conversion receivers would not be affected because their first stage IF is 10.9 MHz.

For the second example, if one person is flying on channel 40 (72.59 MHz) and another is on channel 50 (72.79 MHz) then the sum and difference of these frequencies are 145.38 and 200 KHz. These are the second order inter-modulation products. The difference is the more important of the two since this recombines to produce new third order signals of 72.59 MHz – 200 KHz = 72.39 MHz and 72.79 MHz + 200 KHz = 72.99 MHz. These correspond to channels 30 and 60! Transmitters will generate strong levels of inter-modulation if they are operated too close together. Transmitters on the flight line should be operated at least 20 feet apart.

The things we can do to reduce interference problems that are within our control can be summed up in the following "rules of thumb".

1. Use the new frequency control setup we will soon have installed at the field for channel clearance before turning your transmitter on.
2. Only use modern narrow band transmitters and receivers designed for use on 20 KHz spacings.
3. Do a range check to make sure your transmitter and receiver are working properly. If you can't pass the range check, don't fly until the problem is corrected.
4. If you are using a single conversion receiver, don't operate 45 or 46 channels away from anyone else.
5. To avoid interference with all single conversion receivers, don't operate transmitters 23 channels away from each other.
6. Use a double conversion receiver so you don't have to worry about #3 and #4. They aren't that much more expensive and as you can see from the problems above, they are well worth the extra cost.
7. Do not operate transmitters within 20 feet of each other.

These rules of thumb will not prevent all interference problems but can go a long way toward reducing problems within our control.

Editor's Closing Notes

As was mentioned in the spring newsletter, we are no longer doing a postal mailing but rather emailing only. If you want to continue to receive the newsletter, please provide your email address to Dan at n2mfc@arrl.net. The newsletter (and back issues) will always be available up on the club's web site. Making sure we have your current email address will get you future newsletters which will be published as often as we have enough articles to fill one up and as required for announcements.

Don't have an email address? We'll have paper copies at the field and at regular club flying sessions or you can arrange to get a copy of the newsletter from a member who does have email.

Have a plane, piece of gear, or gadget you think is great? How about doing a review of it for our newsletter? How about writing an article for our fall newsletter?

Have something to post on our web site? **We are looking for good pictures taken at our field for the web site.** We would especially like to see people shots and in-flight shots. Send submissions to n2mfc@arrl.net.

Local Hobby Shops

?? Hobby Hut, 567 Rt.23S, Pompton Plains, NJ 973-835-2077 (next to Saturn dealer)

?? Zeppelin Hobbies and Raceway, 92 Rt.23N, Riverdale, NJ 973-831-7717

?? F and M Hobbies, Rt.10, Dover, NJ

?? Ridgefield Hobby Center, 508 Broad Ave, Ridgefield, NJ 07657 201-943-2636

?? America's Hobby Center, 8300 Tonnelli Ave, N. Bergen, NJ 201-662-0777; 146 W. 22nd St., New York City 212-675-8922

?? Bruckner Hobbies Inc., 3587 E. Tremont Ave; Bronx, N.Y. 718-863-3434

?? U.S. Hobby Inc, 200 Moonachie Ave, Moonachie, NJ 201-460-0544