The Flightline

Volume 34,Issue6 Newsletter of the Propstoppers RC Club AMA 1042 June 2004

Editorial: Flying With The Birds

When I last flew my trusty Skimmer powered glider at Sleighton it was a magnificent flight on a wonderful day last summer. The Skimmer was the first model I built when I returned to the hobby while living in California about seven years ago. The Skimmer was my trainer once I mastered the basics of RC flight with my $25 "Spirit of 76" foam slope-soarer. Especially when we returned to Pennsylvania, since you couldn't really slope soar here.

Dave with his late lamented Skimmer

Agenda for June 1st Meeting
Sleighton Field, 7:00 pm

- Approval of May meeting minutes
- Membership Report
- Finance Report
- Field Report – Sleighton plans and search.
- Plans for Club Picnic (Food items & events)
- Discuss Walt Bryan Memorial Fun Fly plans
- Show and Tell

Bring your plane to fly before and after the meeting

INSIDE THIS ISSUE

It was not an easy plane to control smoothly; it would drop its nose if you didn't get the turns properly coordinated (I now realize I should have reduced the size of the vertical tail). But once I mastered it, the flying was rewarding as it had a good glide and adequate climb. It was also strong enough to take the beginner abuse I fed to it, including consecutive loops to pull out of strong thermals, even with the weight of large battery packs. I even won a couple of "All up last down" competitions with it.

The last flight at Sleighton was typical of one of the good ones. After several climbs and glides to seek out good air I hooked a really good thermal and it climbed with the Hawks as it slowly drifted downwind until it was quite small in the sky. In this relaxed environment, with the warm glow of such a good flight I did not give it constant attention while chatting with the guys. The next thing I saw was the fuselage and tail dropping vertically at high speed and one wing, free and tumbling slowly down. My impression is that the other wing parts were rather fluttering down, but certainly the Hawks were exiting from the center of activity, all going in different directions.

The debris descended into the wooded area surrounding Sleighton School and Del Glennon encouraged me to look for it. Del found the debris field and we searched until we found almost all the key parts. The motor, prop, speed controller, receiver and servos were found, as were some of the battery cells, which had obviously taken the brunt of the impact with a tree limb. The structure was destroyed. Weeks later the complete wing panel greeted my arrival at Sleighton as someone had found it and left it for us at the gate.

Now the Skimmer has a one-piece wing and this was just one panel, the other was completely missing. I know how strong the center section was, I built it strong and tested it regularly with the loops. So what had caused the failure?

I tested the radio and motor components and to my surprise they were all functional, so no radio or servo failure. The battery could have failed or become depleted, as it was a long flight. But this had never happened before and even if this did happen, why would it cause a wing failure? If the elevator servo went hard up, or down it should not have caused the wing failure, as I had flown this maneuver from high speed before, and the initial flight condition here was a slow level glide. Nevertheless, this was my most likely explanation. However, there was one other possibility, the Hawks!

Certainly we have heard of birds flying and getting aggressive with models and when we lived in the Tehachapi Mountains of California one of the thrills was to watch the Red Tailed Hawks hunt the abundant wild life. On a trip to Seattle one winter I took a bird watching tour in one of the city parks where two pairs of Bald Eagles nested. What a sight to see them play by climbing then folding their wings and diving on each other. But I have never experienced a bird attacking one of my planes. Then the other evening I read the following on the SAM Talks e-mail group:

When I was flying my FF Shereshaw Nimbus, at Taft, I noticed a Red Tail Hawk flying formation with me and it slowed down to get behind and above the Nimbus. That Hawk really had guts because the Nimbus was 123-inch span and 9 pounds. The Hawk dove and made a grab for the stabilizer. When it realized it wasn't alive it took off like a shot. When the Nimbus came down, there were talon holes through both the top and bottom silk covering of the stab. When the Hawk hit, the Nimbus pitched up slightly and kept flying. That Hawk really had a tale to tell when it got back to the nest.

I've seen a few gliders (A2 and reasonable sized vintage gliders) with talon marks in the center section where the local magpies have attacked them, they obviously go for what they think are the "shoulders" of the other "bird" Martin Evans

Then from the San Francisco Soaring Sites web page:

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Calendar of Events

Club Meetings

Regular Meeting 7:00 pm
Tuesday 1st June
Sleighton Field

Tuesday Breakfast Meeting
The Country Deli, Rt. 352 Glenn Mills
9 till 10 am. Just show up.
Flying afterwards, weather permitting

Flying Events

Annual Club Picnic and Fun-Fly, Saturday June 19th

Walt Bryan Memorial Electric Fun Fly
Saturday 7th August, Sleighton Field.

Thursday Evenings at Moore Field
Join us for relaxed evening flying. Bring your supper and kids. Let's make this a family affair.
5 pm till dusk every Thursday, weather permitting.

Regular Club Flying

At Moore and Sleighton Fields

Daily	**10 am til Dusk**
Saturday	**10 am til Dusk**
Sunday	**12 p.m. till Dusk**

(Electrics 10am till Dusk)

Propstoppers RC Club of Delaware County, Pennsylvania. Club Officers

President Keith Watson
(610)-543-5050 kwwatson@comcast.net

Vice President Dick Seiwell Reslawns@aol.com
(610) 566-2698

Secretary Richard Bartkowski
(610) 566-3950 rbartkwoski@comcast.net

Treasurer Al Gurewicz (610)-494-8759

Membership Chairman Ray Wopatek
(610) 626-0732 rayweo@juno.com

Field Marshall Al Tamburro
(610) 353-0556 kaosal@webtv.net

Newsletter Editor Dave Harding
(610)-872-1457 davejean1@comcast.net
4948 Jefferson Drive, Brookhaven, PA, 19015

Webmaster Bob Kuhn
(610) 361-0999 kuhnr1600@kuhnfamily.com

Propstoppers Web Site; www.propstoppers.org
Check the web site for back issues of the newsletter, pictures of club events and the calendar of future events.
Pictures courtesy of Bob Kuhn and Dave Harding

The President's Message

Dear Fellow Propstoppers,

Our monthly club meetings will now be outdoors at Sleighton Field beginning at an earlier time 7:00pm. **Tuesday, June 1st is the first outdoor Propstoppers monthly meeting**. What if it rains you may ask? If it rains and we cannot get onto the field we will reschedule the meeting to Thursday weather permitting. Feel free to come early and fly your plane before the meeting and there will be flying afterwards also.

Our Club Picnic is approaching – Saturday June 19th is the date – volunteers are still needed for some food items - see the form in this newsletter.

At Dave Harding's suggestion we have been flying regularly on **Thursday Nights at Moore Field** starting at 5:00pm. It is a success! Many have come to enjoy this mid-week day at the field. It works well if you have a busy weekend and cannot make it out otherwise. Also, you know someone will be there if you need some help. Come join us if you haven't been out, even if you don't have a plane ready to fly it is a good time and you can bring your supper with you or show up afterwards – we fly till dusk falls, usually well past eight o'clock.

Don't forget to join the members at the **Breakfast Meeting on Tuesdays** at the Country Deli, food and good conversation with some flying afterwards, rain or shine.

The Walt Bryan Memorial Electric Fun Fly will be held Saturday August 7th, 2004. Details of this event will be discussed at our meeting and then we will publish them in the newsletter. Have a fun and safe flying season!

Keith Watson, President

Minutes of the Meeting, May 4th, 2004 at Marple Library

The meeting was called to order at 7:30 p.m. by ex-president Jess Davis

Roll call taken by membership chair Ray Wopatek showed 24 members and 1 guest present.

The minutes of the April meeting as published in the newsletter were accepted by the membership.

Treasurer's report by Al Gurewicz was accepted also.

Old Business:

Safety officer Jess Davis investigated emergency services for our fields. He said that Delaware County is acquiring GPS capability for its units this year. President Keith Watson reiterated that we have a first aid kit in a locked box at Sleighton field.

Club picnic-June 19th is the tentative date. The club will provide basics such as burgers and drinks. We're asking for volunteers for condiments and extras.

New Business:

Next month's Club meeting will be held at Sleighton field. The business session will begin at 7:00 p.m. with flying to follow.

The Silent Knights Club of Delaware has invited us to their electric sailplane fly and swap meet on the 8th May.

Dave Harding said that he would sponsor flying at Moore field every Thursday evening beginning at 5:00 p.m. and lasting till dusk. He said he would arrive early and open the gates for anyone who wishes to come.

Show and Tell:

Sam Nevins showed his Hobbico trainer ARF with specs-50 in. span, five and one-half pounds and an O.S. 40 engine. He said it flew straight and level right out of the box and handled very easily.

Propstoppers building Champ, Sam Nevins, with his new Hobbico Trainer ARF. He loves the way it builds and flies.

Dave Harding showed his Irvine diesel powered full-size Lanzo bomber from 1937. He has several other engine combinations that can be swapped in and out including a spark original Olson and an electric system. Dave described the tuning of the carburetor for both longer duration and high-power. He looks ready for another contest season.

The meeting was adjourned at 8:30 p.m.

Richard Bartkowski, Secretary

Editorial; continued from page 1.

Most of the flying sites here have resident populations of various types of Hawks, occasional golden eagles, and turkey vultures. Often the presence of an R/C glider will entice a Hawk or vulture into the ridge lift. There are many accounts of Hawks attacking (and in some cases, bringing down) model gliders

So, there you have it, others have experienced Hawk attacks maybe this is the explanation for my loss. Those talons could easily take out the center section of the wing structure.

I would like to hear the experience of others. Call me; in the meantime let's figure out some countermeasures.

We have begun to fly regularly on Thursday evenings at Moore field. Some of us bring our supper and begin flying at five and continue until dusk that comes after eight at this time of the year. Moore is still magic at this time of day and quite a group is coming out to play. Won't you join us? Just show up, bring a model or two if you like or just join the railbirds. I have been bringing the motor home so a bathroom is available for the ladies, so bring your better half as well. On a recent Thursday two of our new members, Charlie Eshelman and Art Blose, brought out their new trainer, a new Hobbyzone Aerobird Xtreme. The thing flew magnificently in the moderate wind. Both Charlie and Art took the controls with the bird a spec in the sky. A thrill for everyone, the new pilots and the railbirds. By the way, this is a remarkably good flyer.

A group of us attended the Old Time Eagles electric fun fly in Hope NJ. This is always a fun event as it is attended by quite a few of the electric flying notables, particularly the group from North Jersey including Joe Beshar, the organizer, Tom Hunt from Long Island and many others. Each year Joe Beshar holds an Elexaco competition to try to encourage flyers to try their hand. Well, our Dick Bartkowski did it again; he has now won two of the four events, with the same model yet!

Dick Bartkowski takes first place in the Elexaco contest at the Old Eagles meet. His Trenton Terror is a regular winner.

Last year after a particularly good flight he found that control was fading and he put it in a tree alongside the runway. This year, with the full technical attention to all systems, he conquered that particular demon to put in two impressive flights in the high wind conditions.

I recently suffered a failure of my beloved Futaba F8U. On taking it out to do some model testing I found that there was no power. A battery check showed no problems so I looked elsewhere. This is when I noticed a faint but positive electrical burning smell in the case.

On thinking about the problem I believe I put it away with the antenna down and the power switch on; not a good thing. This is because the retracted antenna does not match the transmitter's output power in this mode. They are mutually tuned with the antenna extended and detuned with it collapsed. The manufactures recommend that you only leave the antenna down during the brief periods while doing range checks.

I rely on this transmitter for all my SAM flying because it enables me to set a three-way switch to preset trims for climb, glide and floating glide. The high-powered SAM models climb vertically at much higher speeds than they glide, so a significant amount of down trim is required. Since most of these models are almost out of sight at the top of the climb it is very difficult to control them manually. With the Futaba I can simply set a switch with climb trim and let the model climb virtually hands off. At the top of the climb I toggle the switch to the glide setting and if the conditions are smooth I can select the floating glide setting for reduced rate of descent but with a lower stability margin.

So, since I rely on the Futaba and the first contest is a few short weeks away I needed a quick fix. Keith had recently sent his Futaba 9U back to the manufacturer for a replacement antenna. It cost him $75. I thought that might be the expensive way to get mine repaired so after talking with Rusty I sent it to Radio South in Pensacola FL. Great service, they sent it back to me in less than two weeks for the minimum charge of about $45 including shipping of $10. They reported that there was a "burned trace" on a circuit board. I believe this must have been caused by the overload condition with the collapsed antenna.

Thought you ought to know about the hazard and the good service.

Dave Harding

Tech Note; The Radio State of the Art

By Peter Berg

Radio control technology has advanced a good deal in the last few years and some of the old "Rules" no longer apply, particularly with respect to receiver design. A recent article by Peter Berg in Quiet Flyer summarized the state-of-the-art and indicated that much of his material is on his web site. Herein is that material including some data on transmitter performance associated with crystals and antennae. (Dave)

Much has been written about the performance of "Dual Conversion Receivers" (DC Rx) versus that of "Single Conversion Receivers" (SC Rx). In general, it is assumed that all DC Receivers are 'better' than all SC Receivers, an incorrect assumption, often based on experiences with low-cost park flyer receivers that are, in general, Single Conversion Receivers. Many people have had good experiences with these park flyer receivers; others have had bad experiences with them.

PARK FLYER RECEIVERS These receivers were designed with four goals in mind: 'reasonable' range, small size, lightweight, and inexpensive to manufacture. It will be clear that, in order to achieve these goals, these receivers are designed with a minimum in components to get the job done. As such, they will function adequately when used for their intended purpose, i.e. to control a park flyer type model within relatively close proximity, on a quiet day—and then only when and if not too many other transmitters on other frequencies are around. These small, inexpensive receivers have made a great contribution to the hobby in that their low cost and easy availability has brought an influx of new modelers into the hobby. However, when these newbies started flying in more congested areas or busier flying fields, they often began experiencing all kinds of glitching problems. The reasons are one or more of the following:

ADJACENT CHANNEL INTERFERENCE Say you are flying on channel 50 and someone turns on his transmitter on channel 51. The channel spacing in the USA is 20 KHz. Since nothing in this world is perfect, your channel 50 receiver will see a tiny bit of high frequency radio energy (RF) from the channel 51 transmitter that is radiating RF energy only 20 KHz away from your frequency. Therefore, if your receiver has sufficient RF filtering to reject this small amount of adjacent channel RF energy, you will not have a problem. Good filters are large and expensive. They are typically not used in Park flyer receivers. It gets even worse when your airplane is closer to the other guy's transmitter than to yours.

INTERFERENCE FROM PAGERS AND OTHER TRANSMITTERS Some 25 years ago, when the FCC allocated the many frequencies we are now using, a channel spacing of 20 KHz was assigned. This required the manufacturers of R/C receivers to look for filters that had to provide sufficient neighboring channel suppression at 20 KHz. In the years since then, the FCC has allowed 'other' transmitters to operate in-between 'our' channels. Examples are railroad signaling and communication devices, and pager transmitters. The latter can be very strong because they have much higher output energy than our small R/C transmitters. So, instead of having to design receivers for a 20 KHz channel spacing, the engineers now all of a sudden had to design R/C receivers for a 10 KHz channel spacing, which required the development of even better IF filters! Again, these filters may not be found in Park flyer receivers.

SWAMPING. A weak front-end in the receiver can make it sensitive to swamping. "Swamping" is overload of the receiver front-end as a result of a strong interfering signal on 'any' frequency or channel, as might be encountered by flying the model close to someone else's transmitter or in an area that is close to pager or railroad transmitters. The result is that no signals from your transmitter get through to your model. Not good!

3IM (sometimes erroneously called 3OIM) Third-order Intermodulation (3IM) products are caused by the mixing of two RF signals that are not on your frequency, to produce a signal that is on your frequency. This mixing typically happens in the front-end of the receiver and is caused by operating the front-end in a non-linear part of its range. In simple SC or DC receivers, there is no easy way to fix this; it costs parts, room and money to do so. As an example, say you are flying on channel 50 so your carrier frequency is 72.790 MHz. Now, two more people arrive at the field and they have channels 51 and 52. With a reason-ably good receiver, if either one of them turns on their transmitter, you will maintain control. However, when both of them turn their transmitters on, the following will happen. The RF energy radiated by the transmitters on channels 51 (72.810 MHz) and 52 (72.830 MHz) will create, when encountered by a 'cheapie' receiver's non-linear front-end, several undesired signals, with one of the worst ones being 2x [frequency of channel 51], e.g., the second harmonic, minus 1x [frequency of channel 52] which is (you guessed it!) exactly the frequency of channel 50, which is *your* channel! Now, only a 'good' receiver will suppress this interfering signal set. For this it needs: controlled, very linear operation of the front-end, and other suppression techniques (some of which are proprietary). All these efforts are, of course, not implemented in the simple receivers, because they require (a) additional components with their inherent additional size and weight, and (b) additional cost.

SENSITIVITY AND RANGE Of course, a receiver has to have sufficient range to control the model as far away as the user can (or wants to) fly it. It is clear that a small park flyer or helicopter is kept a lot closer in than, e.g., a pattern or turbine-powered model or a large sailplane. Therefore, most park flyer receivers have a limited range, whereas the higher-end receivers have what is commonly termed "full range." A definition of "full range" would be "as far as you can see your airplane," with sufficient margin that when things go wrong or are not as intended by the original equipment manufacturer (low battery, reduced-size antenna on transmitter and/or receiver), you still have full and reliable control. It should be noted that nowhere in this definition is the term SC or DC receiver used since "full range" has nothing to do with the type of receiver but only with the reliable or usable sensitivity/ range of the receiver.

REJECTION OF SIGNALS ON THE IMAGE FREQUENCY This effect, also known as "Image Frequency Problem," has been the subject of many assumptions, misunderstandings and incorrect statements in recent conversations on some bulletin boards.

Both DC receivers and SC receivers utilize conversion techniques to arrive at a 455 KHz intermediate frequency (IF) for ease of amplification and demodulation. DC receivers do this in two steps (Dual Conversion) and SC receivers do this in one single step (Single Conversion). But in both types of receivers, final filtering and demodulation is performed in exactly the same way, i.e. at a 455 KHz IF. In the conversion process, the incoming signal on, say, channel 50 (72.790 MHz or 72,790 KHz) is converted to a lower frequency by means of a mixing process. Inputs to this mixer are the transmitter frequency (72,790 KHz) and the crystal frequency (xtal freq). Outputs from the mixer are the sum and the difference of these two frequencies, plus a whole bunch of undesired mixing products such as harmonics of transmitter frequency plus-and-minus

harmonics of crystal frequency.

The crystal frequency on channel 50 in an SC receiver is 73,245 KHz, so the difference in frequencies is 455 KHz. The SC receiver filters this out, amplifies it and does some other neat tricks to the signal, demodulates the original transmitter signal and preps it for the decoder, which unravels these data so that it can feed each individual servo. Neat and simple. But…the receiver is (almost) as sensitive to a signal with a frequency that is two times your 455KHz IF (910 KHz) plus your transmitter frequency. As an example, channel 50 is 72.790 MHz; add 910 KHz, and the image frequency is 73.700 MHz. Your receiver will see a signal on that frequency just like your channel 50 frequency. This is a law of physics, unavoidable, and we engineers had better design for it. And we have. We also have a name for it: Image Frequency (IF).

With a DC receiver, things are exactly the same, except that the DC receiver utilizes two mixing processes: the first one typically resulting in an IF of 10.7 MHz, the second one resulting in the (same as for the SC receiver) 455 KHz IF. The (first) mixer has outputs of [transmitter frequency] minus [crystal frequency] and also has an image on the other side, the image frequency. But the image frequency is farther removed from the desired frequency; and, therefore, signals on the image frequency can be filtered out better (to some extent). But…this mixer also produces a whole bunch of undesired mixing products of harmonics of the transmitter frequency plus-and-minus harmonics of the oscillator frequency. Some of these are filtered out in the 10.7 MHz first IF filter, but this filter is MUCH too wide to filter out all undesired signals. This 10.7 MHz filter in a quality DC receiver is a simple two-pole crystal filter with a typical bandwidth of—depending on type—anywhere from 80 KHz to 500 KHz (4~25 channels) at the 35 to 40 dB point. For neighboring channel suppression, a minimum of 60~70 dB is required; thus, this filter does not hack it. Therefore, the DC receiver employs a second mixer, using yet another crystal, to arrive at the same 455 KHz frequency where the SC receiver already was after its first conversion. In this second mixing process, the DC receiver produces additional spurious mixing products (harmonics of input signal mixed with harmonics of the crystal frequency), so there are even more undesired frequencies to which a DC receiver may react. This does not make a DC receiver bad (or good). Nor does it make an SC receiver bad (or good).

Let's tackle the solutions to the above conditions.

ADJACENT CHANNEL INTERFERENCE This requires the use of a very high quality filter in the 455 KHz IF in both SC and DC receivers. Most simple, inexpensive receivers do not have enough room (or money invested) for a really good filter, so they don't use it. Note that there is a difference between "good enough most of the time" and "highest quality."

INTERFERENCE FROM PAGERS AND OTHER TRANSMITTERS Again, this requires the use of a high-quality filter in the 455 KHz IF in both SC and DC receivers. It is ignored in most simple, inexpensive receivers.

SWAMPING. This happens (almost) entirely in the front-end of the receiver. Some receivers can have circuits saturated (swamped) in other parts as well. It requires very careful design. The requirement is the same for SC and DC receivers and is mostly ignored in park flyer receivers.

3IM This requires very careful design. It can be achieved with equal quality in SC and DC receivers. Some manufacturers of DC receivers (FMA) and of SC receivers (JR, Berg, Schulze, Multiplex) use exotic techniques to achieve good 3IM performance. Typically ignored in park flyer receivers.

SENSITIVITY AND RANGE Sensitivity and range are directly related to each other. More sensitivity = more range. However, range should be expressed as "usable range"; i.e., distance you can fly without interference. In some receivers, range is reduced to also reduce the sensitivity to interference from undesired signal sources (other transmitters, spark interference, etc.). With careful design and the investment in best quality parts, both SC and DC receivers can be made sensitive enough to qualify for full range without experiencing interference (glitches).

IMAGE FREQUENCY SUPPRESSION Image frequency suppression is easier in general with a DC receiver than with a SC receiver. This is the only advantage of DC receivers. Design guidelines that favored DC receivers were based almost 25 years ago on then-current technology. Modern integrated circuits and design techniques, better packaging with surface mount technology, and now the use of microcomputers in the decoder, have increased the receiver's ability to separate the good from the bad by carefully weighing and measuring each and every change in the signal it receives from your transmitter and eliminating the signals it receives from any other signal source. The difference in performance between well-designed DC receivers and well-designed SC receivers has all but evaporated.

SINGLE CONVERSION VS. DUAL CONVERSION RECEIVERS (one more time)

There is a place for every kind of receiver. Park flyer receivers belong in park flyers. Do not put them in a large sailplane that you will 'speck out' against a nice blue sky. Do not fly them on congested fields or in domes with conductive (reflecting) trusses. There are some very good single-conversion receivers on the market today. There are also some darned poor examples. There are some very good dual-conversion receivers on the market today. There are also some darned poor examples. In general: Listen to what other people's experiences are, and go with a brand that others have had good experiences with. Otherwise, you are a test pilot. Is your model worth it? OK, and now one-on-one:

ADVANTAGES OF A DC RECEIVER Higher suppression of the image frequency— was useful 25 years ago but today, with much improved 455 KHz filters and microprocessor decoding techniques, not a big issue anymore.

ADVANTAGES OF AN SC RECEIVER Only one conversion step; results in about half the spurious frequency responses. Fewer parts—can be built smaller and lighter with lower cost. Only one crystal to break; DC receivers have three crystals. Take your pick. Peter Berg

Peter Berg started designing radio control transmitters and receivers in Holland in 1960. In the following seven years, Peter designed and manufactured several multi-channel r/c systems using tone modulation with different tones for different functions and produced these under the BFM name. Also, he wrote a monthly column in the Dutch magazine Radio Electronica and published some do-it-yourself receiver articles.

In 1967, Peter emigrated to the US where he spent nine years designing command systems for satellites and, later, advanced video recording systems. In 1976, he joined Kraft Systems in Vista, California to head up the industrial control products department, and later became director of engineering. While at Kraft Systems, he designed what were, as far as we know, the first FM R/C systems manufactured in the USA.

Following the sale of Kraft Systems to an "industrial giant," Peter returned to the aerospace industry, where he was program manager on several national and international aerospace programs.

In 1988, Peter started his own aerospace company,

Berg Systems International, Inc., allowing him to retire in 1996. Since that time, he has concentrated on designing the highest quality receivers for the remote control of model airplanes, starting with the ***Berg-6*** *and the* ***Berg-6 mini****, of which more than 3,000 units are flying successfully today.*

Here are some of Peter Berg's receivers. They are considered by some to be the finest available. This is his latest six channel with the features described below.

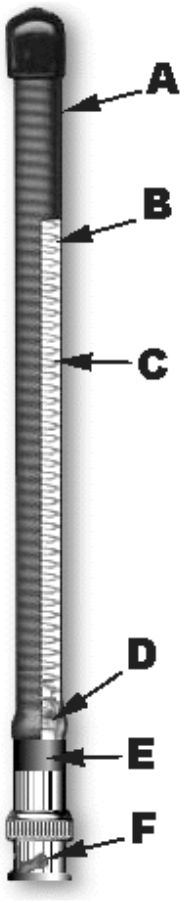
The Berg-6*G III offers the highest performance and largest feature set in R/C receivers today, in an extremely compact and lightweight package. Transmitter Signal Recognition (TSR) means that the receiver learns the characteristics, or the signature of the transmitter, and this makes it compatible with all brands[1] of 72Mhz FM transmitters. Berg's advanced ultra-narrow-band circuitry design bypasses the types of interface found in our R/C field environments, and lets you fly without worry. It includes Fail Safe (FS) or Signal Hold options, Transmitter Signal Recognition, and programmable channel 5 or channel 7.

We have been using this Berg 4 DSP micro stamp receiver in the SAM competitions

It weighs only seven grams, about ¼ ounce but has all the high tech signal processing and features an indicator lamp, which indicates the number of glitches filtered out during the last flight.

Dave

Rubber Ducky v. Whip Antennas



A typical "Rubber Ducky" replacement transmitter antenna.

We ran some field tests using a whip antenna (standard) and a ducky antenna (well-known brand) mounted on equivalent Futaba transmitters using the same RF module.

Measurements were made using a calibrated HP spectrum analyzer as the calibrated receiver. The receiving antenna was a 50-ohm resistor with no directivity or gain (a "monopole"). The distance between the transmitter and the receiving antenna was about 60 feet.

RANGE:

We found a 4~6 dB difference in received signal strength between the factory-standard whip and the ducky. This was to be expected, and the amount of margin built into today's receivers tolerates that, as long as we remember that we are eating up safety margin.

DIRECTIVITY (Ducky):

The ducky is much less direction-sensitive than the long whip. The best angle range for the ducky in the vertical field is: up 30° up to 30° down from horizontal, ok to 60° down, start seeing signal loss at 60° up but not much; measurable loss at 90° (straight up). The best angle for the ducky in the horizontal field is: 30° left to 30° right from pointing at the rx antenna; still ok at 60° left to 60° right with small loss, then, again, a measurable loss at 90° to the receiving antenna. We therefore recommend flying with antenna pointed at the plane plus/minus 30°.

DIRECTIVITY (Whip Antenna):

The standard whip antenna helps create the strongest overall signal strength at the receiver antenna, but we found the directivity to be much more critical than that of the ducky. The best angle in the vertical field: 60° to 90° (vertical). The best angle in the horizontal field: 60° to 90° degrees (max radiation out of the side of the antenna). The worst angle was when the whip antenna was pointed "approximately" at the

receiving antenna and we measured a sharp dip in received signal strength of more than 25 dB. At this short a distance, this would mean a reduction in received signal strength of more than 99.7 percent!

CONCLUSION:

Pointing a whip antenna at the plane is BAD, and pointing a rubber duck antenna at the plane is GOOD. These measurements proved nothing new. We have known for a long time that the antenna patterns are as described above.

DISCLAIMER:

The above measurements are approximate, made with calibrated and sophisticated test equipment but not on a calibrated test range. Overall test data is believed to be accurate and representative.

Peter Berg

Transmitter Crystals

Receiver crystals have to meet only one criterion: when plugged into the receiver, they must operate at the [design frequency] plus-or-minus tolerance. The total allowed frequency "error" (tolerance) is determined by the design of the receiver if filters, tolerances in oscillator components, frequency [in]accuracy of the crystal itself, frequency drift of the crystal with temperature variations, and aging of the receiver crystal -- plus errors in the center frequency of the transmitter (also determined by a crystal with its own tolerances as for the receiver crystal) -- and in the setup (tuning) of the transmitter's shift points.

Now, the transmitter crystal has an added requirement to that of the receiver crystal. First, it is of much lower frequency than the channel frequency, its signal being multiplied a number of times. But (very important!) the transmitter crystal must also meet certain "pullability" requirements; i.e., the frequency change per change in load capacitance. This is how the frequency shift or FM is achieved in the transmitter. In the transmitter, the shift points are individually set by means of two potentiometers or variable capacitors or a combination thereof.

It should be noted that these adjustments would be different for every crystal unless this "pullability" spec is tightly controlled by the manufacturer, which costs money.

From the above, it should be clear that you should always use the manufacturer's crystal so that you will stay within your radio's design limits. Don't forget: all these tolerances build up.

It is amazing that our radios work this well with all these tolerances, but the precision of the quartz crystal helps us here -- you can typically expect a max error in the order of between 3 and 10 ppm (parts per million), depending on brand, which means that your frequency error will be between 3 and 10 times "one millionth times the frequency." For 72 MHz, this would be a total error of 360 Hz (for each crystal) when the tolerance is 5 ppm for each; total frequency error can be as much as 720 Hz in that case.

It will be easily seen that, since tolerance is expressed in ppm, the real (absolute) error at 72 MHz is about twice as great as the absolute error one sees at 35 MHz, with the same crystal specs.

RECOMMENDATIONS:

- Do not change receiver crystals other than with "own brand" type
- Do not change transmitter crystals at all unless you have access to precision lab equipment which lets you set the proper shift points, or you may experience loss of range and/or interfere with your buddy's radio

Peter Berg. http://www.bergent.net/

ALL I NEED TO KNOW TO FLY AN AIRPLANE AND OTHER LESSONS IN LIFE.

Compiled by LARRY BROMAN

- Keep the aeroplane in such an attitude that the air pressure is directly in the pilot's face.
  —Horatio C. Barber, 1916
- When a flight is proceeding incredibly well, something was forgotten.
  —Robert Livingston, Flying the Aeronca
- The only time an aircraft has too much fuel on board is when it's on fire.
  —Sir Charles Kingford Smith, some time before his death in the 1920s
- If you can't afford to do something right, then be darn sure you can afford to do it wrong.
  —Charlie Nelson
- I hope you either take up parachute jumping or stay out of single motored airplanes at night.
  —Charles A. Lindbergh to Wiley Post, 1931
- Never fly the "A" model of anything.
  —Ed Thompson
- Never fly anything that doesn't have the paint worn off the rudder pedals.
  —Harry Bill
- Keep thy airspeed up, less the earth come from below and smite thee.
  —William Kershner
- Advice given to RAF pilots during WWII: When a prang seems inevitable, endeavor to strike the softest, cheapest object in the vicinity, as slowly and gently as possible.
- Instrument flying is when your mind gets a grip on the fact that there is vision beyond sight.
  —US Navy Approach magazine, circa WWII
- There is nothing more useless to a pilot than the sky above him or the runway behind him.
  —Author unknown
- The Cub is the safest airplane in the world; it can just barely kill you.
  —Attributed to Max Stanley, Northrop test pilot
- A pilot who doesn't have any fear probably isn't flying his plane to its maximum.
  —Jon McBride, astronaut
- If you're faced with a forced landing, fly the thing as far into the crash as possible.
  —Bob Hoover
- It occurred to me that if I did not handle the crash correctly, there would be no survivors.
  —Ricard Leakey, after engine failure in a single-engine aircraft, Nairobi, Africa, 1993
- Though I Fly Through the Valley of Death, I Shall Fear No Evil, For I am 80,000 Feet and Climbing.
  —Sign over the entrance to the SR-71 operating location at Kadena AB, Okinawa
- The emergencies you train for almost never happen. It's the one you can't train for that kills you.
  —Ernest K. Gann, advice from the old "pelican"
- If you want to grow old as a pilot, you've got to know when to push it and when to back off.
  — Chuck Yeager

From Flightline
Bay Area RC Fliers
Don Bunyard, editor
Coos Bay OR

Dave Harding – Editor
4948 Jefferson Drive
Brookhaven, Pa. 19015
610-872-1457

Propstoppers R.C. M.A.C

Fun at the excellent 2003 Club Picnic

Club Picnic Saturday 19th June At Sleighton Field

Final organizing session at the June Club Meeting. Be Prepared to help.

We need donations of food and supplies please.

Check the signup-list at the meeting or call Mark Berkemeyer or Rich Bourassa, both of whom are having a difficulty finding the time to do this for you. It's time to step up, members!

June Meeting at Sleighton Field
Tuesday 1st June
Flying 5pm Meeting 7 pm,
Flying afterwards