THE INVERTED FLYER

NEWS of the BOULDER AEROMODELING SOCIETY
AMA Charter # 906

December 2002 Edition

2002 Officers:

President:	Terry Edwards	(303) 499-6463	Secretary:	Russ Larsen	(303) 673-0147
Vice Presidents:	August Bruno	(303) 828-0910			
	Rich Anderson	(303) 652-2224	Newsletter Editor:	Boris Sergeev	(303) 530-2063
	Wendell Wickstrom	(303) 494-9324	e-mail:	BSergeev@excite.com	
Treasurer:	Ken Jochim	(303) 444-3206			

NOTICE: Club Meetings is hold now on the **Second Wednesday** of each month

Next Meeting: **December 11, 2002**
7:30 PM at Boulder TEC Center
6600 Arapahoe Ave., opposite the Valmont power plant
BE THERE!!!

EDITOR'S MESSAGE

At the November meeting, Ken Jochim proposed to publish the list of frequencies used by the club members. Please e-mail to me, bsergeev@excite.com, or to Ken, kjjochim@aol.com, which channels you are using and which are the most frequently used. We will process all the data and publish a histogram in one of the future newsletters.

Unfortunately, the list of club members and their contact info isn't ready yet. I haven't finished the Club Web site too. Will try to do it by the next newsletter issue…

Also, I wan to express my sincere apologies to Richard Rooney, whose last name was miss-spelled in the November newsletter issue. Sorry, Richard…

Sincerely yours,
Dr. Boris Sergeev

BAS MEETING MINUTES

November 13, 2002

The meeting was held at the TEC Center. Vice President Wendell Wickstrom called the meeting to order at 7:30 pm.

Treasurers Report:

Ken Jochim reported a balance of $4555.53 in the checking account.

Old Business:

VP Wendell complimented Boris Sergeev on doing a good job with the newsletter.

Rudy Glick made a number of name tags and distributed them to members. It was also reported that Richard Anderson had a design for member name tags.

New Business:

VP Wendell reported that that some CU students had talked to Ken Jochim about starting a club of their own. Ken suggested that they join our club at a reduced rate. Brian Hargrave, their professor, thought that it would be a good idea.

The BAS Constitution lists a junior membership class, with current annual dues set at $15.00. Augie Bruno made the point that if they were members, then they would have to follow the rules rather than just going out to the field to fly. Glen Miller made a motion to offer them membership, with annual dues set at $15.00 and Augie Bruno seconded the motion. There was unanimous approval.

Dean Chandler suggested that a set of rules be given to each of the student members. It was decided to print the club rules in the newsletter.

Ken Jochim asked members for a list of their channel frequencies and the most frequently used.

Augie Bruno asked to discuss the new benches at the field. Members seemed to like the new benches; however, most felt that the space to set the radio and other equipment is too small. Members were generally in agreement that at least some of the old tables should be kept, as well as possibly adding more of the new style. The discussion was tabled until next meeting when Richard Anderson can be there. After reading in the newsletter, members are asked to give feedback to Richard Anderson.

Election of Officers:

After a motivational talk by VP Wendell, the following members were nominated for office:

President: Terry Edwards

Vice Presidents: August Bruno
Richard Anderson, nominated by Dean Chandler
Wendell Wickstrom, nominated by Dean Chandler

Treasurer: Ken Jochim

Secretary: Russ Larsen

Newsletter Editor: Boris Sergeev

There was unanimous approval to elect the full slate of nominees.

Other Information

Terry Edwards shared his experience with a pesky woodpecker, which destroyed a model airplane in his hangar.

Tony Kilwein did show-and-tell with his 50% scale Miss San Bernardino plane. We were all amazed at the amount of progress in only 14 hours building time!

Editor's remark (and some creative photo editing): At such speed, Tony and his plane will look like this by the time you are reading the newsletter:

Tony promises to have the project completed very soon. It should be a great looking model.

The meeting was adjourned at 8:20 pm.

FLYING FIELD HOURS

9:00 am to dusk on weekdays
10:00 am to dusk on weekends

INSTRUCTORS LISTING

Call if you need help getting started!

Dean Chandler	(303) 652-2125
Steve Croft	(303) 651-9104
Jacque Harvey	(303) 661-9779
Tony Kilwein	(303) 438-8500
Wendell Wickstrom	(303) 494-9324

ON THE HORIZON - Next Club Meeting *(SECOND WEDNESDAY of each month)*

December 13th, 2002
Boulder TEC center

CLASSIFIEDS

This spot's for YOU. Phone, email, or snail mail your item to the editor, and we will publish it the next month. No charge to BAS members

THE YELLOW PAGES

A listing of area merchants whose products are of interest to model aviation enthusiasts; provided as a service to our members. Some will give you a discount with your current club card.

Boulder Hobbies, 2125 32nd Street, Boulder (303-442-8669), Phil Battany

Mile High Wings sales@milehighwings.com The source of R/C Simulator interfaces: www.milehighwings.com/joystick.htm BAS members get 10% discount!

Action Hobbies, 1477 Carr, Lakewood, (303-233-6275), Glen A. Magree

Hobby Town, 800 South Hover Rd. Longmont, (303-774-1557) Jim Koln

Don's Hobbies, 815 10th Street, Greeley (970-353-3115) Tony Farro

Things with Wings, 6268 W. 10th #2 Greeley (970-352-1067) Jim Richardson

Hobby Town, 6815 W. 88th Ave., Westminster, (303-431-0482), James Miley

Hobby Giant, 5545-A, Olde Wadsworth, Arvada, (303-940-9238), Larry Cencich.

Heliport Hobbies, 1400 W. 70th Street, Denver (303-430-8828) Also Magnum Fuels

BOULDER AEROMODELING SOCIETY FIELD RULES

GENERAL

1. The gate shall remain closed and locked when club members are not present.

2. All flyers shall be members of the ACADEMY OF AERONAUTICS (AMA).

3. All flyers shall abide by the AMA Safety Code and BAS Rules.

4. Glow or gasoline powered models will not be operated before 9am Monday thru Saturday or before 10am on Sunday.

5. All flyers shall use extreme caution and be courteous to all persons at the field.

PARKING

1. Fifteen minute parking is permitted behind the shelter for the convenient loading and unloading of equipment. After equipment has been loaded or unloaded all vehicles must be parked in the parking lot.

2. Handicapped parking is provided near the shelter for vehicles displaying a handicapped license plate or a state issued window tag.

FREQUENCY CONTROL

1. All transmitters shall be kept on the impound board except when you have pinned up on the frequency board and are actively using your transmitter.

2. The maximum time to use a frequency is 20 minutes if there are others on your frequency.

3. Channels 20 and 21 are prohibited.

FLIGHT STATIONS

I. When flying a model, each flyer shall clip his/her AMA card on one of the sliders and place the slider directly below your frequency pin.

2. A flyers shall stand on or near one of the flight stations while the aircraft is in the air. The flyer my leave the flight station during take off and landing operations.

FLYING

1. All flying shall be east of the east edge of the north/south runway except for take off and landing operations.

2. If the wind is predominantly from the east or west, it is permissible to fly in an east/west direction over the roadway just north of the field as well as north/south as stated above.

3. When taking off or landing, all flyers shall, in a loud voice, announce his/her intentions and the direction from which the operation is being preformed.

4. When retrieving a model, the flyer shall announce his intentions such as ON THE RUNWAY or whatever may be appropriate.

5. The use of the east/west runway is permissible for landing and take offs and landings during winds coming from the east or west. However, all flying shall be performed as stated above.

6. The first turn after take off shall be away from the centerline of the east/west runway.

7. Flying over the pits or spectator area is strictly prohibited.

SAILPLANES

1. Sailplanes shall be flown in the southwest quadrant of the field.

2. Sailplane flyers shall claim a frequency and use it as above as long as the do not exceed the 20 minuet requirement and attach a card to their frequency pin with the words FLYING SAILPLANES.

3. If a winch is used, it shall be placed in such a way so as not to allow the towline to cross or fall onto the runways.

4. When launching a sailplane, the flyer shall make certain that no powered aircraft are in or approaching the launching area.

Currently, the Club Rules are being extended to regulate helicopter flying. Once the new revision of the Rules is ready, it will be published in the newsletter.

ARTICLE OF THE MONTH

James Mack, a member of our club, has kindly offered to publish his article on PCM Modulation. Due to size restriction, only a short version is published here. You can find the whole article at James' web site, www.jmack.net, under Radio Control/Tips and Tricks.

Please send your questions and/or suggestions to James e-mail web@jmack.net.

PCM MODULATION

Background

PCM and PPM are both encoding methods used for FM signals, and PCM is not a totally different transmission method like AM. Therefore, the PCM signal is affected by the same interference as a PPM signal. The reason PCM works better isn't because it gets less interference, it is simply better at dealing with it.

There is a fundamental difference between PCM and PPM signals. A PCM signal is digital, and a PPM signal is analog. In a digital signal, there are two distinct states, on and off, and to mistake one for the other requires a significant amount of interference. In the analog signal, there are a continuous number of states representing the signal, and interference can cause each state to shift to an adjacent one. Therefore, a PCM receiver will work perfectly, without failsafe or dropped frames, under much higher interference levels than a PPM one.

The digital signal allows the PCM system to perform additional functions as well, because additional data can be added to the signal. Firstly, PCM radios send what is known as a "checksum", which adds redundancy to the system by allowing the receiver to check that the data it is receiving is not corrupt. In fact, the checksum is so effective that it is nearly impossible for a receiver to incorrectly accept invalid data. If the receiver determines that the data is invalid, it will hold the last position. Almost all PCM radio systems also transmit "failsafe" data, which is used to set servo positions when signal is deemed corrupt for more than about half a second.

For a great, technical, in-depth explanation and comparison of PPM and the various types of PCM, visit this site: www.aerodesign.de/peter/2000/PCM/PCM_PPM_eng.html

Failsafe

Failsafe is a function of most PCM systems that allows the system to move the servos to a predetermined position upon loss of signal. Usually, there is an option for each channel to either move to a preset position or remain at the last commanded position. Because of the nature of failsafe, it can never be disabled. The PCM system knows when the data it received is invalid, and simply cannot be made to act upon it.

When many people first hear of failsafe, they think its a system designed to save models. Although it can, if properly programmed, it is really a system designed to save people. An all too common failsafe approach is to attempt to put the model into an attitude where it can land safely without control. However, unless you're flying a noseheavy rudder only plane with ample dihedral, there's really no control input that will land the plane safely without input. The overwhelming majority of PCM receivers are used in models which are, at best, neutrally stable. There is no single control input that will save such a model from every attitude. Therefore, a different approach is necessary for proper failsafe setup.

The best failsafe setup for most models is to hold all channels except throttle, and set the throttle to a predefined idle point. This accomplishes two things: it puts the models in a predictable low power path, and it provides a possibility of recovering control when the engine is responsible for interference. For spectators, the easiest models to avoid are the ones that are moving slowly and in a consistent path. Nothing is harder to avoid than an erratic model flying full bore. PCM can accomplish this by reducing throttle and maintaining all other control inputs at their last position. Furthermore, when the throttle is reduced, any engine related interference is likely to disappear, and control can be regained. Especially in gas models and helicopters, engines are responsible for vibration or electrical noise which accounts for a large portion of radio interference incidents.

It must be noted that this "best" failsafe setup is not the default for any known PCM radio. It has to be set explicitly by the user. Therefore, if you are a pilot using PCM, I suggest that the first thing you do when you set up a model is set up failsafe. You won't have time to set it up later when you need it.

Range Testing

Range testing of a PCM system is different from range testing a PPM system, because PCM systems don't exhibit any "glitch" upon loss of signal. When a PCM receiver nears the extent of its range, it first stops dropping "frames", or servo position commands. If enough frames are dropped in a row, the radio goes into failsafe until signal is regained. At no time do the servos jitter or bounce like PPM systems.

When range testing PCM radios, most pilots set failsafe to move throttle to idle, and walk the transmitter away from the model. When the throttle moves to idle, failsafe has been enabled, and the end of control range is assumed. This method fails to consider that, at some point before failsafe is activated, frames are being lost, and control is lost for small periods. Sometimes, frames are lost as early as 20-30 feet, even though the distance where failsafe enables seems normal.

If you wish to determine whether or not the PCM radio is getting the analog of PPM glitches, a different range testing method is necessary. To do this, one control needs to move smoothly back and forth during the range check. The stick needs to be moved as quickly as possible without going faster

than the servo can physically move. If, when watching the model, the surface hesitates, the system has received a glitch. If hesitations occur closer than 150 feet or so, there is a radio problem that needs to be addressed.

This range testing method addresses one of the most common criticisms of PCM radios; that there is no indication that signal is about to be lost. There is an indication, you just have to look differently to find it.

Myths

If it wasn't for PCM failsafe, I could have saved the model.

If your model enters PCM lockout, there is already enough interference to render a PPM receiver unusable. Furthermore, the erratic glitches of a PPM receiver are just as likely to crash a model as a PCM failsafe's "hold". The fundamental problem is that there was enough radio interference to keep the radio from functioning properly, and no receiver, especially PPM, will help when that occurs.

It would be safer if I could turn off my radio's failsafe function.

PCM's failsafe function is intrinsic to the nature of PCM. The fact that PCM is a digital signal with signal integrity checking means that the receiver knows when the signal is getting interference. If the radio were to act upon these errant signals, the resulting glitches could be several times worse than the same glitches in PPM, although slightly less frequent. If a signal is getting interference, the best thing to do is ignore it, and hold the servos in a predictable position in hopes that the signal returns.

I don't like PCM because I can't tell if there is interference or not.

Most of the time, you can tell that there is interference. PCM masks interference for three reasons: signal quality, failsafe, and checksum validation. Because the PCM signal is digital, it is less susceptible to interference, and interference that results in glitches in PPM will have no effect whatsoever on PCM. Failsafe activation is a sure sign that the interference is high enough that a PPM receiver would have long ago been rendered useless.

Of more concern is the last reason for interference masking: checksum validation. When a checksum validation fails, the frame is discarded, and the servos hold their position until the next valid frame. If enough frames are discarded, the radio goes into failsafe mode. However, some people contest that there is no way to know glitches are occurring until the radio enters failsafe. This is untrue, however. On the ground, you can test for dropped frames by moving the surfaces slowly during a range test and watching for hesitation. In the air, the model will feel unusual when frames are being dropped. The feeling is akin to servos pausing or getting stuck briefly. This might not be noticeable to novice pilots, but I believe most experienced pilots would be able to recognize a receiver that was dropping frames.

If I enable failsafe properly, the plane will land with minimal damage.

Most of our models don't fly very well in free flight. If you happen to be flying a model that can fly hands off for long periods, then perhaps this logic is valid. However, if you're flying a helicopter or a typical aerobatic plane, there's really no control inputs that will unconditionally save a model. Trying to save a model should not be the goal of your failsafe setup, the goal should be to save anyone who happens to be in that model's path upon loss of control.

PPM is more responsive and more precise than PCM.

This is a remnant from older PCM systems, which were inferior to the systems we use today. Modern PCM systems have resolution higher than most servos. At worst, modern PCM systems are as responsive as their PPM equivalents. In some cases, such as Futaba's PCM 1024, the responsiveness is even greater than PPM systems.

If PCM goes into lockout, it takes forever for it to come back.

A PCM receiver takes roughly 3 times as long to regain control after signal is restored. This equates to about 60 milliseconds. 60 milliseconds is faster than any normal human can react to the control being restored, and its also faster than the servos can respond to control being restored. So, it may take longer, but the delay won't be noticeable. People think there is delay for signal acquisition because the receiver generally takes a second to respond when it is first turned on. The delay you notice when you turn on your radio is not the same delay you'll notice when you regain signal in flight, because the radio has to go through initialization routines when it first turns on.

Safety

PCM has a number of safety advantages over PPM, all of them relating to the predictability of PCM's loss of signal behavior. When a PCM receiver loses signal, or gets one with significant interference, it will either hold servo positions or move them to predetermined "safe" places. This is in contrast with PPM, which could do anything, from holding the servos to moving them to the extents of their travel. A few examples might clarify my point.

Let’s consider a pylon racer flying the course at full speed. If this plane was subject to interference with a PCM radio, the throttle would cut and the model would continue on its path, which is predominantly away from spectators. In the case of PPM, the throttle would not be cut, the plane may become erratic, and there's a chance it would head for the crowd. Again, this is not a purely hypothetical situation, as I have seen it myself.

Note to members receiving newsletter by snail mail:

If you send the editor your email address, we can send you the newsletter by e-mail. This saves the club 37 cents each newsletter PLUS you get all the pictures in color rather than black and white. And you get it a couple of days sooner.

The Inverted Flyer is published monthly by the Boulder Aeromodeling Society as a service to its members. Submissions for publication are encouraged and can be but are not limited to: articles pertaining to Aeromodeling, letters to the editor, short news items of general interest to BAS members, and announcements. Space permitting, all submissions will be published except as follows: no anonymous letters or any submission containing morally objectionable content or language, as judged by the editor. Classified ads will be provided to the members of BAS free of charge. The deadline for all submissions and classified ads will be the first of the month for publication on or about the first Wednesday of the month. Opinions expressed in the Inverted Flyer are not necessarily those of the Boulder Aeromodeling Society general membership.

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