Servo Chatter

May 2007, Issue #123
Official Newsletter of the SCCMAS "Tomcats"
AMA Club Charter #110
www.sccmas.org

20 year dinner celebration.
See page 10.

Next Meeting: Thursday, May 24, 2007 at 7 PM .

Location: Hayes Elementary School. See map on page 4.

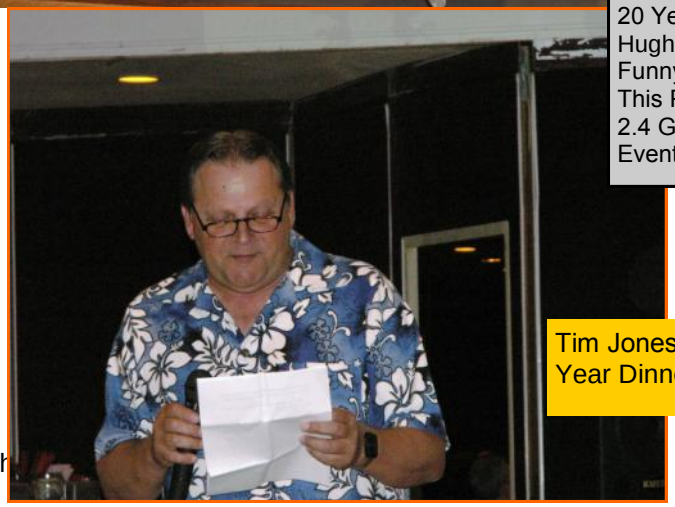
Gregg Uhlendorf hovers his Century Helicopters 2003 Hawk Sport . Pat Rose photo.

Norman Sly's park flyer GWS F4U Corsair coming in for a strafing run. John Adams at the controls.

See Hughes H-1 photos on page 13.

Pat Rose photos.

In This Issue



Tim Jones presents "This Person" at the 20 Year Dinner Celebration. See page 15.

Flyin Fast - President's News
By Michael Luvara

The SCCMAS was started informally in 1983 and entered an official capacity in 1986 when the first field was opened on the other side of hwy 101. In 1987, the SCCMAS opened its current facility. Since then, we have enjoyed the fruits of a world class facility. Quite a lot has progressed in 20 years. I've done a lot of reflecting on the club in the past few months in preparation for the club's 20 year banquet. I went through and read a good portion of the original newsletters, trying to collect information about the club when it was created. I talked to members who we hadn't seen in a long time and invited them to the banquet. Most of all, I looked at the SCCMAS and realized how we take our facility for granted at times. Most clubs are happy to have a mat covered runway and field to fly off of. We have that and much more. Sometimes we need to step back ourselves, take a deep breath and be appreciative for what we are able to enjoy with fellow modelers.

If you missed the 20 year banquet, then you sure missed out on a great time. With 98 people, great stories, great food, a great time was had by all. Chris Luvara put a wonderful DVD together that we gave out at the event and will soon have available online. Some DVD's may still be available at the next club meeting.

You'll notice the head of my column changed this month, with the subtraction of "Vice" in VP. I really have not ever seen myself as anything more than a motivated member working to help keep our club going, but we have to have titles sometimes. At the 20 year event, it was mentioned that we should remove the Vice from my title. Most of you know that the SCCMAS is quite different from most other clubs. We don't hold elections and do our best to eliminate politics. Board members are appointed and are here to serve the best interests of the members and hobby. The core values of the founders were to have a flying field where the concentration is on flying and fun and I believe those instilled values are still with us today. I've been part of the governing board since 1996, when my brother and I jointly took over the newsletter responsibilities. In 2001, I stepped up to help out in the VP's position and have been doing my part to help make the SCCMAS a great place.

In March, the Parks Commission took a big step forward in approving the integrated 20 year master plan that they have been working on for several years. This puts us closer to the bathroom project. More will be reported as we know it.

The SCCMAS will again be attending the Watsonville full scale fly-in this year doing static displays and flight demos. This is a fun event and is a great way for us to reach out to the community. If you are interested in attending as a participant for flying or static display, please let myself or Steve Smith know.

The annual Airshow is right around the corner. If there is an area that you are interested in helping or participating, email airshow@sccmas.org. See Steve Smith's article for further details.

I need to mention commercial sales at the field. Until recently, it has not been an issue, but we have seen a prevalence of hobby related commercial vendors wanting to offer items for sale at events, swap meets, etc at the SCCMAS. The governing board has wrestled with this issue and issues of county compliance, to see if we could come up with a reasonable solution and balance it with the SCCMAS's core values. It was decided at this time to not allow any outside commercial vendors to sell onsite at the SCCMAS premises. Hobby shops, vendors, etc will still be allowed at specific events, etc, but will not be allowed to transact business (the taking of orders/sales) onsite at the SCCMAS premises. There will obviously be issues in enforcing this and we will do our best to ensure compliance. Some have already brought up questions about some sellers at flea markets, etc. The intent of the SCCMAS flea markets/swap meets is for individuals to sell personal items, not commercial for-profit ventures to come onsite. If you have any questions regarding this issue, please contact myself.

On May 7th, we had a brush fire at the field. No one was hurt and the fire was put out. The fire was started, oddly enough, by an electric jet that crashed. The battery is reported to have shorted out on impact. Please remember that we have the field address and emergency contact numbers listed at the field on the porch and at the rear of the impound.

Until next issue, Michael

From the Editor

By Pat Rose

Way too many projects in the works. Recently I upgraded my 60 size Edge from a Thunder Tiger 61 to a Tower Hobbies 75—this added the power the plane needed and now supports unlimited vertical. I ordered a Bisson Pitts style muffler over the web and found it to fit well. *See www.bissonmufflers.com.* The engine runs just fine with this muffler. Strange that the 75 just dropped in without the need to rework anything. I work on and off on my Northrop Gamma—my wife asks me if it will ever fly—I wonder the same. (BTW, I have had several planes built from scratch that would not fly.) I'm building from enlarged AMA plans. The interest in this plane started when I bought a cast metal model at an antique store. Power will be a Magnum 91 with a Bisson Pitts style muffler (again, ordered over the web) — these Bisson's are high quality products.

Then there is the Xtra Easy powered by an OS 46 that a guy gave to me at the field. He was cleaning out his storage locker and wanted to get rid of it. I was lucky (or unlucky?) to be at the right place at the right time for this one. The plan is to have it ready for the Airshow. I have enough spare parts in the "hobby shop" to get the plane into the air. The previous owner said he had a problem with aileron flutter. Upon inspection of the model, I found the aileron servo mount to be loose. This "find" supports my pre-flight procedure to take hold of each servo and try and move it back and forth to see if it is loose. Same with the rudder and elevator surfaces, plus the engine.

Just for fun, with the price of gasoline hovering over $3.25/gallon, I calculated that it costs me for gas about $3 to drive my truck to and from Sheldon's. It costs around $9 to drive to and from the Skyport from Sunnyvale. I have talked to other pilots who drive even farther. o

$$\frac{53\ miles}{round\ trip} \times \frac{1\ gallon}{20\ miles} \times \frac{\$3.25}{1\ gallon} = \frac{\$8.61}{round\ trip}$$

Upcoming Meeting: Thursday, May 24, 2007, 7 PM

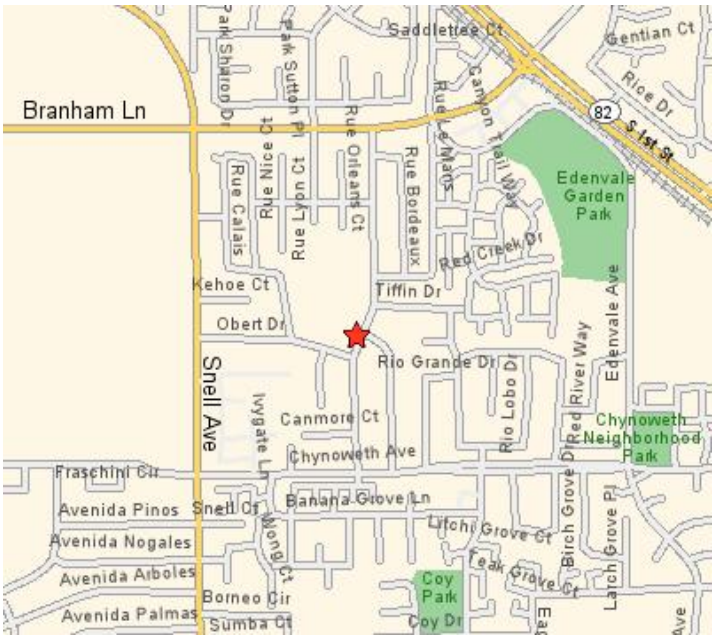
The next meeting will be held at Hayes Elementary School, 5035 Poston Drive, San Jose, CA 95136. Program this address on your GPS or use Mapquest for directions.

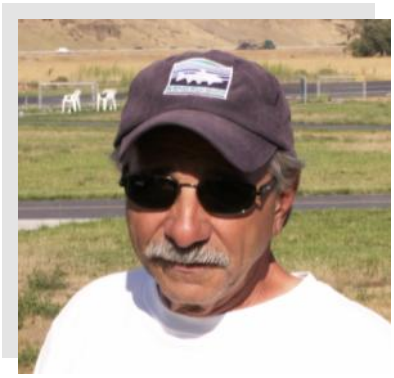
Raffle prizes will NOT include the usual - tools instead of a radio, a kit, adhesives and lots of other stuff.

Bring your latest project for show and tell and receive a free raffle ticket. Coffee and donuts during the break.

Future Meeting Dates:

TBD





From The Secretary's Building Board

By Rich Luvara

Meeting notes for 3/22/07

54 members present… also present were two guests, Ron Evans and Jim Pasco.

The latest new solo was Mathew Smith.

Show and Tell

Mathew Smith showed a Hobby Lobby "Piggy 3D"made of foam and powered with a brushless motor …Mathew used this plane to solo with, according to Mathew it can be built in one day and also easy to repair.
Don Coulter showed the carbon fiber and pink foam wing that he built for his racing corsair, weighs 1 pound; total weight for the aircraft is 6-½ lb.
John Ribble brought an electric trainer that he was going to use as a test bed for an Aurora pattern plane. It uses li-poly batteries and he expects 10 min. flights.

Mathew Smith with Show and Tell

John Ribble during Show and Tell.

Raffle

Dave Silva-.55 AX motor donated by D and J hobbies,glue
Mark Siminov-Sealing Iron and a Slot- Machine.
Don Coulter-set of screw drivers, and servo screws.
John Ribble-sealing Iron.
Pat Rose-sanding bar, pushrods, glue, sanding bar..
Steve Smith-3 rolls of monocote..
Bervin Britt-sealing iron.
Jim Pascoe-sanding block.
Merle Culp-Balsa filler.
James Gale-Monocote, balsa filler.
Dick Gardner-servo screws.
Mathew Smith-servo screws.
Don Laughridge-servo screws.

Dumb Thumb

The dumb thumb was won by Bervin Britt.o

Contest News

By Steve Smith

This May is much calmer than years past as no events were scheduled at the field. But this is the calm before the storm; many events are scheduled in the next several months. But a quick recap. On Saturday April 21st the skies were buzzing with the World Model Sky Raiders for a day of racing. Fun was had by all, with four rounds of racing and the trophy race we finished in the early afternoon. For the future - The Memorial Day Weekend May 26th and 27th, SCCMAS has been invited back to the annual Watsonville Airshow. SCCMAS will have a booth with club members answering questions about the hobby and a static display of planes ranging from trainers to flying witches to giant scale. SCCMAS has been asked put on a 20 minute flight demonstration for the public each day with several types of aircraft flying simultaneously. This is a fun event for the entire family.

In preparation for the summer season, we are planning a field maintenance work party on Saturday June 2nd from sunrise to early afternoon. **The field will be closed to flying during this time**. So bring those handyman skills, shop tools, gardening tools, trimmers, paint brushes and gloves to help brighten up your facility. **Lunch will be provided.**

SCCMAS will be hosting the annual Giant Scale Fly-In on June 9th followed by an evening Spaghetti Feed free to all pilots. Contact Lynsel Miller at (408) 374-9358 or John Mota: (408) 842-2542 for additional information or visit our club website at www.sccmas.org. On June 23rd , SCCMAS will be hosting the third stop of the T-34 Triangle Series. This is sure to be an action packed day of fun. Contact Kevin Norred at t34racing@yahoo.com for registration and additional information.

What's lurking over the horizon? The annual SCCMAS Airshow July 7th and 8th is approaching fast! Preparation is underway with a kick-off meeting held in April. The shack preparation is underway with a laundry list of items reviewed before that trip to Costco which usually fills up two pick-up trucks. This year we are planning additional helper meetings prior to the Airshow to coordinate tasks. With the large public turnout, we need to be prepared with designated helpers to answer questions, police the static display, field safety, monitor frequencies and the impound area, setup, tear down, burger flipping, work the how-to/building booths, help with lunch time training, etc. If you would like to be a part of this prestigious event contact Mike Luvara at (408) 292-1212 - mike@sccmas.org or Steve Smith at (408) 234-0095 - contests@sccmas.org

Helpers, helpers, lots of helpers are needed for events over the next several months. Several opportunities exist at the Giant Scale Fly-in and T-34 Races for shack managers, pylon judges, lap counters, field setup and tear down. If you can volunteer for any of these events please contact Steve Smith at (408) 234-0095 - contets@sccmas.org or catch me at the field on Sundays. Manage the shack for one event and receive one-half off your 2008 annual dues. Manage the shack for two events and your 2008 annual dues are on the house. Open dates are listed on page 12.

See you at the field….

Contest News continued on page 12.

Training

By Mike French

Mustang - The Hard Way With Style

It is uncommon for people today to seek the harder challenge. But there are uncommon people who do and who succeed. Chuck Bellemare is one such man who has become the first person in my recollection to pass through SCCMAS' primary flight training program using as his trainer a Mustang. Tail dragging planes in general are more of a challenge to get into the air than tricycle gear craft. There is a critical speed in which the tail wheel isn't very effective and the air flow across the rudder is still weak leading for a time to poor directional control. A Mustang as a breed of plane represents the high end of maneuverability and response. As primary trainer? I still don't think so. But Chuck did it. I have had many people email me who have wanted to buy the Hanger Nine Mustang as their first plane. The best way I think to gain an insight to using this plane for preliminary instruction is to have the opinion of the man who just succeeded. I have asked Chuck to write an article to be included here as a review of his experience in learning to fly at SCCMAS with this plane. [photo - Chuck's grandpa provided constant support]

Chuck Bellemare:
For as long as I can remember, I have always dreamed of flying RC nitro planes, specifically war birds. When I decided to join SCCMAS Tomcats I started researching all the different kinds of trainers on the market. The one I chose was the Hanger 9 PTS P-51 Mustang ARF. For me the decision was simple, I could satisfy both of my dreams at once.

The Hanger 9 PTS Mustang is a nice quality made kit. I was very impressed with the ARF construction and easy to follow instructions. The kit comes with 4 *training* items that can later be removed or modified. 1) Fixed down flaps, 2) Air brakes attached to the wheels, 3) A 3-bladed prop to reduce air speed, and 4) Wing cuffs to help stabilize the plane and reduce tip stalls. Most of these training items were modified or removed from the plane on the first few flights because they did nothing but slow the plane down, which could be easily done with proper use of the throttle. Also, with all these items to slow the plane, you compromise the ability to increase throttle enough to get yourself out of trouble. Most of the time, we were forced to fly full throttle, just to keep the plane airborne.

Coming into flight training with my PTS Mustang I read a bunch of reviews and read over the information on the Hanger 9 website many times. I also borrowed my friend Ryan Luder's flight simulator to give myself all the tools needed to for a successful training experience. I met with Mike French the last week of September to start flight training. Mike took one look at the P-51 Mustang and said, "They may say this is a trainer but this is a Mustang…and not a trainer but, if you're willing… so am I." I knew going in that the PTS Mustang would probably be more difficult than the classic high wing trainers but I thought, if I can learn to fly with a low wing plane I could easily move on to other more challenging kits.

Training continued on page 12.

Safety

By Tim Jones

Another winter behind us and the new flying "Season" begins. The mild winter was good to us who play outside. It allowed us a lot of opportunities to fly and meet up outdoors that most of our counterparts in other parts of the country didn't get. Safety wise, we've done well. But we do need a few reminders as we go into the real flying season.

There has been a lot of activity and a few reminders have been brought up in the Jet Start-up areas and pads. The jets draw a lot of attention and the larger scale aerobatic planes take a lot of ground space. As such there is a growing tendency for a chat group to gather around the jet pad while the flier is checking or preparing his craft for a flight. The problem is that the jet pads are in the safety zone. There is also a 25 ft rule for jets to spectators. This is one of the reasons that the jet pads were put in - to get the jets away from the startup area

While the field map shows this area as a "Red, or No Fly" zone, it is also a safety zone or buffer area to ensure the safety of spectators at our field. Please remember to keep this area as clear as possible and that "Non-Essential" personnel (spectators) are not allowed beyond the pit area. If setup and check-out are going to take any time, bring the model into the pit area where chat and help are always encouraged.

I was witness to and part participant in an incident that occurred at another club site. The incident resulted in an injury that certainly could have been more serious than it was. The incident involved a model being set on the runway for take off. On release and acceleration, the plane made a hard right turn and ran into the legs of man alongside the flight area. The resulting prop inflicted wound in his calf required a trip to the hospital, some stitches and a set of crutches. It was agreed that the pilot did no wrong. It was also agreed that the release procedure was typical and no obvious error was made. However, there was an injury.

This incident created a moment for all to sit back and think about how this happened and what we, all of us, have to consider before releasing a model for take off. What we learned to consider was the question "What happens if?" What happens if this plane doesn't do what I expect it to? What is my emergency procedure? What if the engine fails on take off? What if the ailerons or elevator malfunction? Where can this plane possibly go and what is the danger to the safety of people in the area? The corrective action in this case and as in most cases was a very simple change in the release procedure. The improvement to safety was immediately obvious.

So, I ask all to take a moment before releasing, or turning away from, or beginning a take off roll of a running model, to look ahead and to the sides of the model. Ask yourself, "What if?" "Do I have room for corrections?" "Do I have the safety of others foremost in my mind?"

Some of these questions are hard to ask yourself. But they are much easier than asking yourself, "How did I let that happen?"

Hopefully something that provokes thought,

Tim

Treasurer's Report

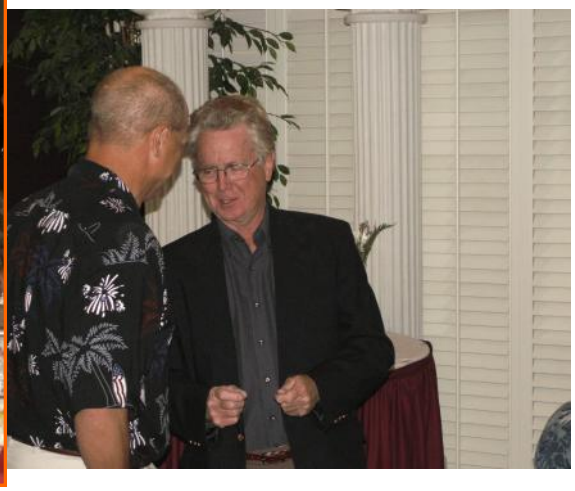
By Jim Patrick

Profit & Loss
March through April 2007

Ordinary Income/Expense		
Income		
Donations		100.00
Food sales		295.00
Membership dues		2,720.00
Swap meets		330.00
Vending machine		447.00
Total Income		3,892.00
Expense		
Club Meeting expenses		100.00
Computer supplies		193.51
Equipment Rental		75.00
Food		633.85
Garbage service		345.82
Insurance		
Fire Insurance	1,023.43	
Total Insurance		1,023.43
Licenses and Permits		80.00
Postage and Delivery		455.85
Printing and Reproduction		748.85
Repairs and Maintenance		
Equipment Repairs	170.02	
Field repairs	23.48	
Janitorial Exp	50.00	
Total Repairs and Maintenance		243.50
Sanitation service		1,455.06
Supplies		292.58
Telephone		
Internet	209.85	
Telephone - Other	196.19	
Total Telephone		406.04
Trophies		819.70
Utilities		
Gas and Electric	132.38	
Total Utilities		132.38
Total Expense		7,005.57
Net Ordinary Income		-3,113.57
Other Income/Expense		
Other Income		
SCCMAS Banquet		2,254.11
Total Other Income		2,254.11
Other Expense		
20 year Banquet		4,140.31
Total Other Expense		4,140.31
Net Other Income		-1,886.20
Net Income		-4,999.77

20 YEAR DINNER CELEBRATION AT THREE FLAMES RESTAURANT
28 APRIL 2007

Pat Rose photos.



Training continued from page 7.

For me flight training was something I looked forward to every weekend. At work I would daydream about what I was learning and talk about my flights with the guys. It also gave me something to look forward to towards the end of a long work week. Each week I would be asked the same question from my wife and friends, "So…. When do you think you'll be finished with flight training?" This was a difficult question because I felt very comfortable flying the plane, but the issues I was having came with the take-offs and landings. These are areas where a tricycle landing gear plane would have helped. The PTS Mustang is a *tail dragger* and had all the nasty characteristics of a tail dragger.

I have been asked if choosing the Hanger 9 PTS Mustang was the right choice to learn to fly with. This is a difficult question, for me the answer is 100% Yes! I loved every minute of flight training with my Mustang and would not have changed a thing. Would I recommend it for everyone? No. For me it was a dream that came true and I was willing to put in any extra time it would take. Would I have completed flight training sooner with a classic trainer? Probably yes. But, would I have loved it as much? That's the question you'll need to ask yourself… o

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Contest News continued from page 6.

June 9th	**Giant Scale "Scale" Fly-In**	
June 23rd	**1T34 Triangle Series**	
July 7th & 8th	**Annual Invitational Air Show**	**ALL MEMBERS**
August 4th	**Flea Market**	**John Ribble**
August 11th	**Sport Warbird Races**	**James Gale**
September 8th	**Electric Fun Fly**	**Chris Tryhorn**
September 29th	**Pattern Contest**	**James Gale**
October 6th	**T34 Triangle Series**	
December 1st	**Flea Market**	
December 9th	**Toys 4 Tots-Bob Whitacre Memorial**	

Gallery 105, Golden Age of Aviation, Smithsonian, Washington, D.C.
Hughes H-1 **Photos by Pat Rose**

Some of the design advances that enabled the H-1 to achieve its many speed records were its close-fitting, bell-shaped engine cowling; retractable landing gear; flush riveting on the fuselage; and gently curving wing fillets between the wing and the fuselage.

A Funny Thing Happened at Hewlett-Packard Company

A bit of Tomcat History, by Pat Rose

I was working at HP in 1998, and my job title at the time was Project Leader. I had responsibility for the HP EMC Test Facility on Homestead Road in Cupertino. The engineering work was a little overwhelming as new measurement standards were coming into effect. There were several technicians in the test facility team but they did not have the skills to implement new measurements. The bottom line was that I was in need of an engineering intern; unfortunately, we were maxed out in head count – but that did not stop me from trying. I suggested to my boss that we terminate one of the technicians who had trouble showing up for work and hire instead an engineering intern. He would think about it.

In the mean time, I sent Michael Luvara an email suggesting that he come by to have a look at the facility. I knew that he was an engineering student at SJSU from his contributions in Servo Chatter. (He was working at Sheldon's at the time.) He showed up in Cupertino at the agreed upon time and mentioned that he didn't exactly remember me, but that his dad (Richard) had mentioned that I was the guy who flew a red Stick.

Anyway, I showed Michael around but told him that we did not have an opening right now but that I thought there would be soon. Time dragged on for weeks without anything developing and I was afraid Michael would get an offer from someone else (turns out someone else at the club was trying). I told Michael that I was still trying to find him a job but that there was nothing yet and please don't get discouraged.

Meanwhile, I was flying this nice yellow kit built P-51, with retracts, at the Skypark, when I had this really violent mid-air. The P-51 was destroyed. I had run head on into Michael's father Richard's plane. According to Michael, his dad told him "You can forget about that job at HP. I had a mid-air with Pat Rose."

Then it happened, the marginal technician missed another days work. I convinced my boss that we should replace him with Michael. Done. Michael came in while he was a Computer Science major. I started him off by learning to perform the existing measurements, and writing some code for a maintenance program. After having so much fun, apparently Michael changed his major to EE. Michael later took on full engineering responsibility projects as his course work supported.

According to Michael, his dad told him "You can forget about that job at HP. I had a mid-air with Pat Rose."

I remember Michael telling me that he was starting early on his senior project, designing some sort of a real time flight data sensor. I remember watching his design take shape and witnessing a demonstration at the Skypark. I would joke at work that during the week Michael would report to me at HP, and on the weekend I would report to him at the Skypark, as he was a Tomcat officer. Michael and I published an IEEE paper together; our last collaboration at HP.

Michael in 2002 at Pat's retirement party.

You may remember that Compaq merged with HP. This merger spelled the end for my HP career and I retired in June of 2002. Michael lost his job not too much later after I retired, and I heard he started his own company, RCATS. The rest is well known history. o

This Person, Behind Us..

Presented by Tim Jones at the 20 Year Dinner Celebration

We, who enjoy our hobby, often spend a lot of time preparing for the field time enjoying the ultimate goal of flying our model planes. We spend time building or assembling, painting, and covering our models. We spend time flying our models. We spend time shopping for new models. We spend time repairing our models. We spend time modifying our models. Usually, we have a regularly scheduled day that we go to the field.

Most often, there is someone in the background quietly helping us enjoy our hobby. This person is often very good at showing interest in a story or a discovery about our hobby. This person is often called upon to provide an extra pair of hands to help hold some complex assembly together while the glue sets. This person often stifles a laugh when we are trying to get our fingers separated from something we've accidentally glued them to.

This person sometimes helps wash out a wound created by the slip of an Exacto knife or a razor blade followed by a band-aid. This person is often called upon to crawl around on the garage floor with us, to help us find the lost little set screw that somehow always seems to disappear on a perfectly clean floor. This person sometimes sits in the emergency room with us when we truly discover how unforgiving a prop is. This person has often had a role in our teaching ourselves the art of bringing large boxes into the home or shop without letting this person know it's there. This person has helped us refine a talent for explaining the justification for another large box that showed up on the front porch. This person often asks the question, "Why did you get another airplane?", only to get the answer "Because I don't have one of these" or the dreaded "It was on sale!". I love when I get to use that one.

The help this person provides is priceless and often thankless. But if we think about it, most of us can't have near as much enjoyment in our hobby without this persons help. Often, the thanks come in the form of our exhibiting how much we enjoyed their help and companionship in some aspect of the hobby. Sometimes the thanks come in the form of alone time at home with a book, while we're gone to the field.

With this in mind, I'd like to read to you a short writing from one of our club newsletters. This appeared in the May '96 newsletter, while access to the field was closed due to heavy rains washing out the road, eliminating access to the flying site by car or truck for several months.

This little writing is titled "Innocent Bystander"

Let me start by saying that it all started when I learned that the field was going to be closed and I simply remarked that "There's more to life than flying an airplane", and the response was "No there isn't". I knew I was in trouble.

The closing of the field hasn't hurt any member as much as me (and I'm not even a member). I have (had) three members that live (lived) in my (our) house that are just miserable. Life has been a living hell, being here with these three for the past 2-3 months (eternity!). They haven't spent this much time at home in years, and I know I should be happy because a few (long awaited) things have been done around the home (like painting, a new kitchen floor, etcetera). But, I am not, because I have had to listen to moans and groans, cussing and just put up with their moods (especially on some of those beautiful sunny days we have had).

You should have seen them building this cart, to carry their belongings on, a couple of days before the Sunday they were going to walk in. They spent all kinds of hours (late) arguing over which wheels go on front, which ones go on back and where to place them. But, they got it done (except get a mule to pull it) just in time for the heavy rains on Sunday to make that trek into the field impossible. Go Figure! I don't think if we lost our house, it would be as traumatic as them losing the field for a while!

I think I'll actually throw a party when this field reopens. I know I'll celebrate somehow. ALONE!!

Signed,

No choice- but to become a member……

The person responsible for this writing is our own Pat Luvara. While her husband, Rich and her two sons, Mike and Chris are typically more widely known for their participation in the club, Pat has been the person in the background not only for the three mentioned in the little story, but for all of us who enjoy our flying site.

So, please join me in expressing a hearty thank you to Pat and all Wives, Mothers, Daughters, Girlfriends, Sisters and any others who are those persons behind us, providing the help that we often take for granted, while we enjoy this hobby.

Thank You…… o

(This presentation edited for length in Servo Chatter, Ed)

The 2.4 GHz Phenomenon

By Michael Luvara mike@rcatsystems.com

It seems as if we are in a new era of R/C with the 2.4 GHz spread spectrum radio systems coming to market. I've been monitoring the chatter on the internet regarding these new radios and felt that it's time to offer a perspective from outside of the manufacturers themselves. There's quite the marketing war going on right now; along with misconceptions about how the systems operate being spread around. My discussion will center on discussing the differences of 72 MHz vs 2.4 GHz and some theory on their operation, so it's up to the individual to choose which system best fits their own needs.

First, a little bit about my background – I've been an avid modeler for 20 years, have an electrical engineering degree, HAM license, spent 4 years in an electromagnetic compatibility (EMC) facility at Hewlett-Packard and my day job includes designing telemetry systems for unmanned aircraft. I've spent a lot of time working with systems that operate in the ISM (Industrial Scientific & Medical bands), where these new 2.4 GHz systems operate, so I certainly understand the complexities and challenges of their implementation. It is my feeling that there are a lot of misconceptions floating around regarding spread spectrum systems and I hope to shed some factual light on the issues and operation of such devices.

We've probably all seen that Spektrum (Horizon Hobby brand) introduced the DX6 2.4 GHz radio aimed at park flyers in 2005, while the DX7 (7ch, "full range") was introduced in 2006. Spektrum also has a set of modules for standard radios coming this summer, along with 9ch and 12ch radio systems. Futaba released a 6ch system in 2007, and will be introducing modules for legacy systems. A brand new 12ch radio system is coming too. Another company, Xtremelink, has a set of modules that they are releasing that will fit most current radio systems. Nomadio, who does car radios, has mentioned that they will offer a radio and Hitec hasn't said much about what they intend to do. It certainly is an interesting time in R/C to say the least.

Let's step back and take a look at the 72 MHz radios that we utilize today. Awhile back, the AMA and a group of interested modelers were able to have a portion of the 72 MHz band allocated for usage of R/C aircraft, as secondary users. This was huge in the fact that modelers had a more protected band for their usage of models and this paved the way for the type of transmitters that we are accustomed to. In 1991, the bandwidth of our transmitters was narrowed, enabling 50 frequencies to operate. Radio manufacturers are permitted to configure their radios to transmit using as much as three quarters of a Watt of power (0.75 W). Very few radios put out this much power and most fall in around one quarter (0.25 W) to half a Watt (0.5 W). Some of the lower end radios are as little as 100 mW (1 mW = 1 X 10^{-3} Watts), which is still more than adequate for most RC applications.

So, we fast forward to today. We now have 2.4 GHz radios coming about. At first glance, the antennas are almost non-existent, due to the shorter wavelength of the particular frequency and many claims are being made about these systems being more resistant to interference. Generally, this is true.

Advantages of 72 MHz band

- 72 MHz has its own allocated band for R/C
- Much better signal propagation than higher frequencies
- 100 mW to 750 mW (.75 W) achieves very good range (farther than we can see)

Advantages of 2.4 GHz band

- Hopping and spread spectrum decrease interference possibility
- No crystals needed
- Allows two way communication and data transfer (i.e. telemetry)
- R/C models don't generate interference at 2.4 GHz, thus less EMI problems
- Short antenna
- Increased bandwidth will allow for higher channel count.

Disadvantages of 72 MHz band

- Relatively little error correction
- R/C electronics (motors, etc) generate low frequency EMI, and affects radios
- Long antenna, sometimes hard to place on models
- No control of others turning on the same channel

Disadvantages of 2.4 GHz band

- Other devices exist that put out as much as 1 W, potentially causing issues with R/C systems
- Signal propagation not as good as lower frequencies
- Very directional signal
- Lots of devices on 2.4 GHz band, although most are lower power, some are as much as 1 W

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First, a little background on the ISM band. The FCC (Federal Communications Commission) governs radio frequency usage in the United States. They set guidelines for who can utilize frequencies throughout the radio frequency spectrum. These guidelines state what limitations are on transmission power, time, what type of data can be sent and a few other items. Along the frequency spectrum are ISM (Industrial, Scientific, and Medical) bands. These are allocations of frequencies that can be utilized for various types of transmission. It's essentially an open band that needs no license (like commercial, amateur radio, etc) to operate on. This enables a wide variety of applications to use this band. From cordless phones, toys, to wireless video cameras, etc. Because the 2.4 GHz band is regulated fairly similar around the world, the RC market has now adapted its usage to controlling models instead of 900 MHz (mostly USA use) or other available ISM bands (433 MHz, 5.8 GHz).

There are two basic fundamental theories of operation for systems working in the 2.4 GHz band. One is to use a FHSS, (frequency hopping spread spectrum) scheme, or DSSS (direct sequence spread spectrum) scheme. Both of these are similar in principle. They move the data around across frequencies rather than staying on one dedicated frequency. I won't go to much into detail on theories of operation, but a search on the subject via your favorite search engine will net some good reading material.

The reason spread spectrum was created by engineers was to provide a robust way of transmission that is not easily decoded, listened in, or jammed on because the frequency and code is always moving around. It is also used to skirt the rules, so to speak. This is true in the computer realm where processors were emitting strong signals on single frequencies. By spreading the processor's signal, the average power on a certain frequency is much lower. In my EMC testing days, the processor's signal was referred to as "Batman", because it was a flat topped signal with strong peaks on each edge, thus looking like a Batman profile.

Since you generally can't put out much more than 1 mW (milliwatt) if you are constantly transmitting on one frequency in the ISM bands, the FCC has rules if you want to put out more power. The answer is simply to move around. Basically, the systems only stay on a certain frequency for a small amount of time and then move to the next. The way systems are tested is by looking at the average power on a certain frequency over time. If you move around, the average value for a particular frequency over time will be less. The more frequencies that you hop across, generally the lower the average will be for a particular one.

Because the systems hop around or spread the code across a frequency, the potential for interference is mostly a probability. Sure, the system may collide for a short amount of time on a particular frequency with some other device, but because the system has a digital link, it can detect a bad data packet and deal with it or retransmit the data so that it gets through. Most 72 MHz systems have a much harder time with this, partly because two way communications is not allowed and error correction is not as easy. PCM radios will "mask" the bad data and ignore it. Many claim they have a more locked in feel with no glitches. That's because the systems hide or toss out the bad data. One of the advantages with 2.4 GHz is that the systems can send servo positions/commands much faster. Instead of approximately 50 Hz (50 Hz = 50 times per second) updates, the spread spectrum systems have much more bandwidth and send data much faster (like 100 Hz), therefore if some of the data is lost, you still have a very good update rate. However, it should be noted that humans generally have a response rate of 2-3Hz, so it is likely that many will not feel the difference in more data being sent.

Generally, everything in life is about compromise and there is certainly no free lunch here. The engineers working with 2.4 GHz systems have had to overcome many obstacles and make many compromises in the use of the systems. Spektrum and Futaba both have a "diversity" antenna system, whereas the unit constantly monitors which signal is stronger on the two antennas and feeds that to the receiver. This helps alleviate what is called "multipath". Signals take many routes towards their intended destination. These fall into two categories. The first is a direct path. The second is a reflected path. Radio signals basically bounce off of objects, hills, the ground, etc. Some radio waves will collide and lower the signal level, causing a null (signal cancellation). Others will add and cause it to be stronger. Because the 2.4 GHz wavelength is so much shorter than 72 MHz, our models move through this phenomenon much more frequently. A good description of this comes from Cisco at the following link: http://www.cisco.com/warp/public/102/wlan/multipath.html

It is also beneficial to note that most of the 2.4 GHz systems we are seeing transmit utilizing 125 mW or less power. A 2.4 GHz system operating at 125 mW will not transmit its signal as far as a 72 MHz system at 125 mW, due to the path losses being different. As you go higher in frequency, the less distance it will go on a given power. This is one area where the 72 MHz

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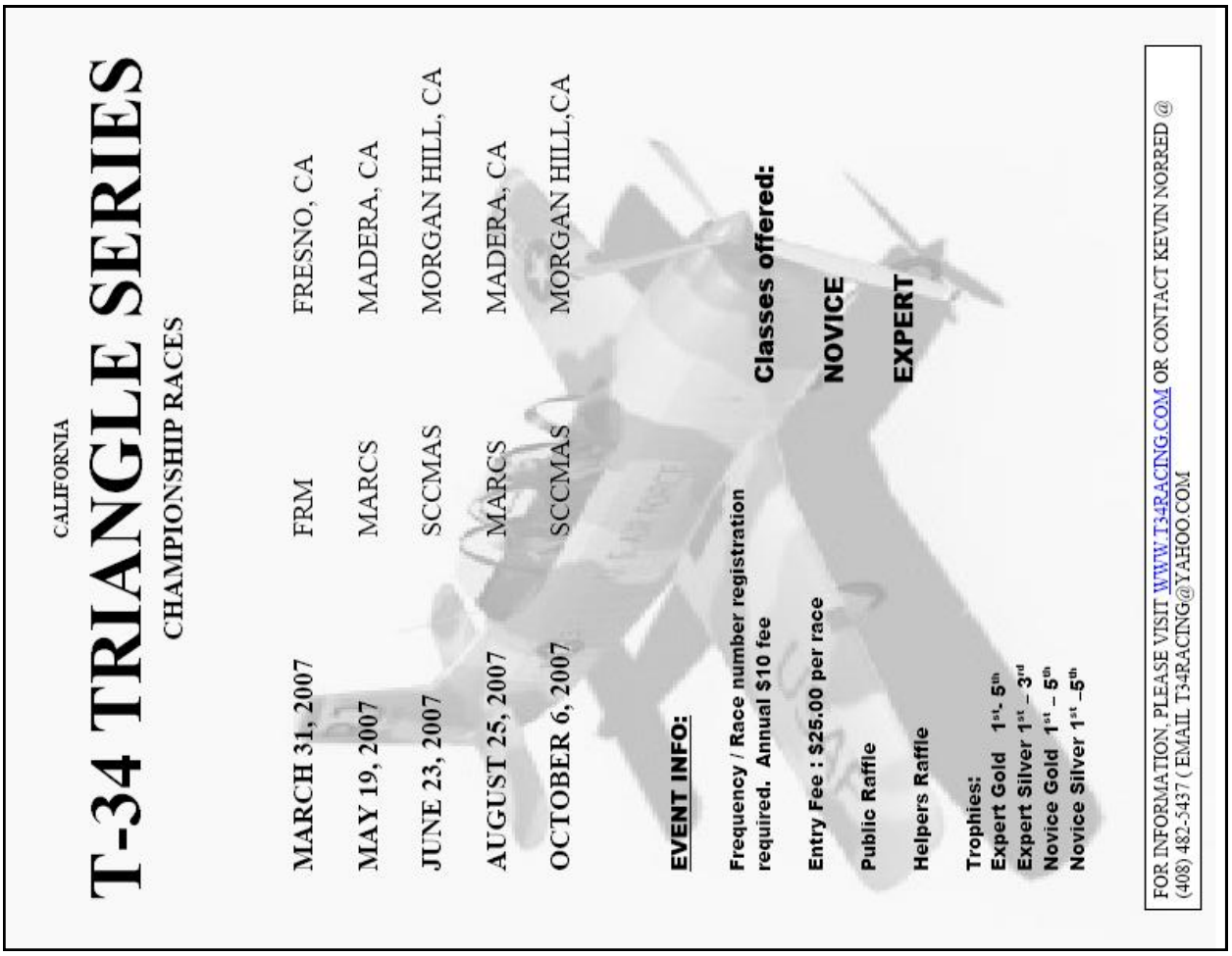
radios have an advantage, since their signal will propagate better through the air, however, how well a receiver can hear signals is a factor too. In RF (radio frequency), there is a saying called “he who screams loudest wins”. If you have the strongest signal, generally it will be heard at the receiver.

Looking at several of the systems out on the market, there are some distinct differences. Spektrum (Horizon), uses a direct sequence spread spectrum scheme and actually utilizes two channels to send the data on, giving two redundant links. If one fails, they still have the other. Their system essentially uses two 1 MHz wide channels to spread the data code across. Because they move the code around, this is the “spread” part of the system. Futaba, on the other hand, is reported to have a hybrid DSSS and FHSS system. Typically a FHSS system uses relatively narrow channels and hops across them very fast, however, Futaba appears to have a wide channel that moves around, while using digital modulation.

How all of these various systems from different manufactures work together is yet to be fully seen. As more and more users adopt 2.4 GHz systems, time will tell. The issue becomes when there are many systems operating simultaneously. This raises the “noise floor”. Think of it like a crowded restaurant. Sometimes the noise is so loud that one cannot hear what the person across the table is saying. The noise level (or noise floor) in the restaurant is elevated where it is hard to hear. The same happens with RF. The receiver cannot decode its signal through all the noise, causing a slow down in data rate and reduction in good data packets.

One common misconception floating around right now is that “All devices must play nice with each other”. While true in concept, this is not reality. The spreading of data and randomness of frequency hopping are what make the systems operate together and co-exist. Because they cannot both be on the same channel for an extended period of time, interference probability is reduced. This isn’t to say that there will not be problems with many systems operating at one time. The FCC’s part 15 statement says that all devices should accept interference that they receive. This is true for our 72 MHz radios, as is 2.4 GHz. There are no guarantees that either will work 100% of the time.

So, in closing, I hope this document has shed some light on the differences, pros and cons about 2.4 GHz and 72 MHz operation. As more systems come out and improve over time, we’ll see how things pan out. The next few years in R/C will certainly be interesting. o



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Next meeting on Thursday, May 24, 7PM, at Hayes Elementary School.

Note: Work party scheduled for Saturday, June 2nd.