Servo Chatter

March 2025 Issue

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President’s Message

By Steve Smith

Hello Tomcats,

Spring has arrived! This is the time of the year we experience more activity at the field, our members, newcomers to the hobby and guests, all enjoying the remote control model aircraft hobby. The SCCMAS is popular stop for Park visitors along the South Coyote Creek bike path. Over the past year we have had several Park visitors wanting to try their hand at flying a remote control model aircraft. The SCCMAS offers a free flight training program. The SCCMAS supplies the model aircraft and we setup a time with one our introductory flight instructors. The rest is history, with previous visitors returning with a model airplane in hand to continue on the journey learning to fly. 2024 was another successful year for flight training at the SCCMAS with over 20 new solo pilots off all ages buzzing the skies with their model airplanes. Over the last several years we have experienced a growth in popularity for remote control model aircraft from families and teens. Flight training information contact us at training@sccmas.org. Let’s keep the momentum going.

This time of the year we experience a large turnout at the field. The SCCMAS offers six flight stations to fly from. Over the last decade the existence of electric aircraft has reduced the setup time to fly, making it easier to just walk out and fly. To be fair to all pilots wanting to fly, there is a flight board in the motor startup area. All pilots are required to clip their SCCMAS card to one of the available six flight stations where you will be flying from. Once your card is clipped to a flight station you can take a turn flying. After completing your flight, remember to take down your SCCMAS card and place it in the tray.

This indicates that a flight station is available for use. At times, this will require self-policing, as cards may be still clipped to an open flight station. Check around to make sure no-one is in the process of preparing their aircraft for flight in the motor start-up area. Please do not move your aircraft out to the flight station area and wait for an open spot, use the flight board! Let’s work together to make this a smooth process for an enjoyable experience.

To kick off the year, the SCCMAS will be hosting a members meeting on Sunday April 13 from 12:00 to 2:00PM at the SCCMAS field. The meeting is open to all members and their guests. New to the hobby and would like to join us, contact info@sccmas.org . The annual Warbird Fly-In returns on Sunday June 7th from 9:00AM until 4:00PM. Open to all Warbird R/C model aircraft from any era, any size aircraft, any motor type. More information is available at www.sccmas.org.

See you at the field,
Steve

From the Editor's Desk

Newsletter Editor - Liam O'Connor

Greetings Tomcats -

Welcome to the March 2025 issue of Servo Chatter! I hope you all enjoyed the holiday season, and that you are having a great 2025 so far. In between some much needed rain, we have had many excellent flying days at our Field over the past few months. We also hosted another SCCMAS Club meeting in October, which was well attended. A core group of dedicated members also completed some much needed Clubhouse repairs at our work party in November.

I continue to be impressed by seeing so many new members joining our club, both young and old, and completing their flight training. A special thanks to all of our SCCMAS flight instructors for sharing the joy of RC flight with newcomers, which grows and strengthens our Club and the hobby in general. In particular, I want to extend a special thank you to Dave Neves (pictured on following page), who recently moved out of the Bay Area to be closer to his family. Dave selflessly and enthusiastically served as flight instructor for several years, and helped countless pilots earn their wings. Dave will be sorely missed by our Club and our students, and we hope he will come back to visit SCCMAS often!

If you would like to promote the hobby and benefit our Club by being a flight instructor, please reach out to Club leadership as we are in need of volunteers to fill Dave's role.

I hope all of you will enjoy this issue, which includes key information from SCCMAS leadership and volunteers, a recap of our quarterly club meeting and work party, a summary of upcoming events, plenty of photos of our recent activities at the flying field, and a construction article by SCCMAS member Andy Keates, detailing his autonomous twin engine balancer.

I would also like to remind our members that if you have anything you would like to share in our newsletter, please send it to me at the email address below. We are always on the lookout for stories, articles, building tips, photos, etc. that we can include in Servo Chatter.

Until our next issue, I wish all of you a fantastic spring full of flying, fun, and happy landings.

See you at the field!

Liam

servochatter@sccmas.org

Tomcats Reminder:

–All Tomcats Members must lock the main entrance gate behind them each time they enter and leave the SCCMAS Flying Field.

Cover Photo: Courtesy of Steve Smith. Isaac and Spencer celebrate certification of completion of their solo test flights.

THANK YOU DAVE NEVES!!!

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Construction Article

By SCCMAS Member, Andy Keates

Autonomous Twins

An autonomous twin balancer

One nitro engine can be temperamental enough. Two seems like a recipe for disaster, so until now I've never ventured into twins. But what can an engineer do in retirement except dream up solutions to technical problems? There are probably other ways to solve this problem, but I created my own. Enter the GizmoWorx (that's me) twin-saver.

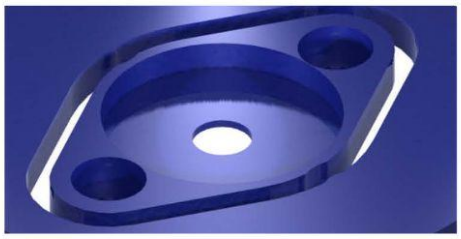
The objective is to overcome the reasons that twins can crash:

- One motor stalls and the other one is still on power.
- One motor runs faster than the other and the plane yaws.
- One engine accelerates faster than the other.
- The two engines don't idle at the same speed.
- The two engines don't have the same top speed.
- One engine runs out of fuel and stops.
- ... and probably more.

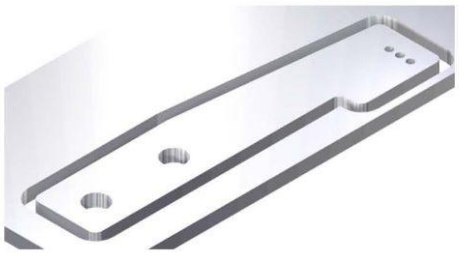
My answer is the twin-saver. This article outlines the successful device with only high-level references to things that didn't work on my journey of discovery.

RPM detection

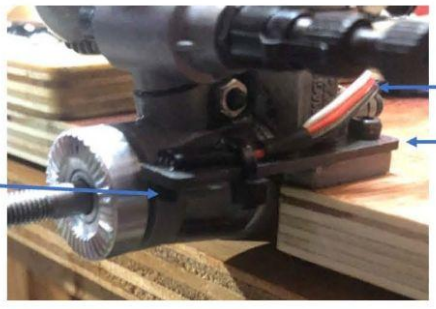
I tried using opto-sensors and hall-effect sensors to detect the spinning of the props. The more reliable and lower power solution was hall-effect sensors. I built magnet mounts to fit over the propellor drive plate of the engine, as seen in the graphic. Its shape was dictated by protrusions in the back of the spinner baseplate. The small magnets are a push-fit into the holes right at the edge of the drive plate.



The hall-effect sensors are mounted on small platforms held in place by the engine mounting bolts. The platforms securely hold the sensors a couple of millimeters away from the spinning magnets. The sensor itself is a tiny 3-pin device glued under the platform, with its 3 leads poking through and soldered to the signal wires as shown. Insulated with heat-shrink tubing, of course.



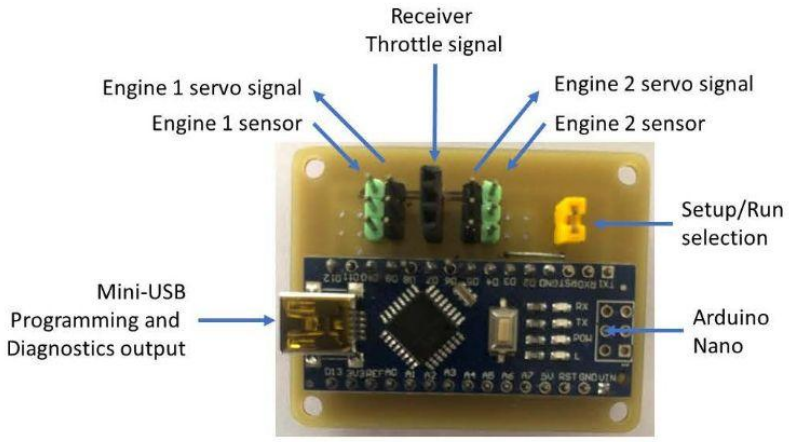
Seen on an oscilloscope the propellor sensor signal is a very clean square wave with about a 1:3 mark:space ratio. On the control board, the code reads the pulses from the propellor sensors, adds the high-time of the pulse to the low-time of the pulse, and that's the period of half a revolution, there being two magnets behind the prop.



Construction Article (con't)

Control board logic

I used an Arduino Nano board to do all of the signal processing. The picture shows it with the connectors labelled.



Now comes the tricky part. Timing. The CPU on the Arduino has three timers in it, and the operating system uses them to run timing functions. If you use the ***servo*** library for the Arduino, it uses one of the timers. The ***pulseIn()*** function also uses the timers, and you want timers for the output pulses to the two engine servos. Let's count all the things that require a timer:

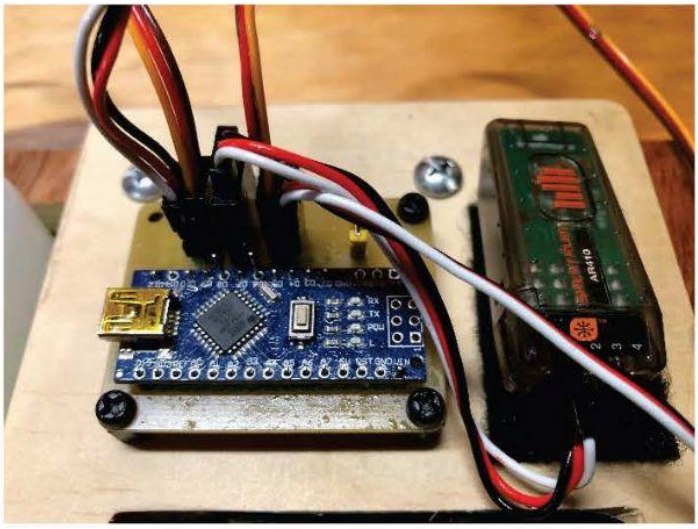
1. The width of the throttle input pulse
2. The width of the engine 1 prop signals (ie the duration of a half prop rotation)
3. The width of the engine 2 prop signals
4. The width of the engine 1 output control pulse (to engine 1 servo)
5. The width of the engine 2 output control pulse (to engine 2 servo)

If you try to run these in parallel, they start to interfere with each other, and you get servo jitter as a result. So, the answer is to run them in series.

The objective is to process the five things I listed above one after the other while still maintaining a reasonable refresh rate for the pulses sent to the engine servos. You can add up all the milliseconds involved in executing the five functions and find that it takes longer than an RC transmit frame at idle speeds (it takes longer to detect the prop blade going past at low RPM). Having two magnets helps to reduce the time spent measuring the prop rotational period. The other thing I did was to read only one engine per update cycle (an update cycle would ideally fit inside an RC transmit frame). By alternating the engine reads, I don't have two half-prop-periods in every update cycle. These two measures make it much quicker to run an update cycle, which I think fits inside an RC frame for all but very low revs.

Construction Article (con't)

Coding logic



The whole point of the twin-saver is that if one engine shuts down, it shuts down the other one. Hence, you can't start one engine if the other one is stopped. So, to run either engine and tune it, I put a jumper across two pins to engage setup mode. In a model, I'd have a switch connected to the jumper. Setup mode directs the input servo pulse straight out to both engines.

In run mode, the circuit board calculates the RPM of each engine, and adjust the servo pulse of the faster engine to bring its speed in line with the slower engine. If one engine stalls, the other one stops. During testing I was mentally thinking ***YES!*** when one engine stuttered, the other followed it, then the bad engine recovered and the good one matched it.

This all sounds straightforward, but there is a learning curve. The engines take a while to accelerate or decelerate, so when you apply an RPM correction, you are trying to control a steady-state RPM that hasn't settled in yet. Without some clever processing the RPM will overrun and oscillate around the set point (the speed of the other engine).

The classic solution to this is a PID controller. That a standard industry term for a control mechanism to move something into place and have it stop where it should.

P = proportional. Apply a servo pulse correction proportional to the RPM discrepancy.
I = integral. Add the RPM discrepancies over time, apply more correction if nothing's changing.
D = differential. Compare the RPM gap this cycle with the last cycle and slow down if the gap is closing too fast and headed for overrun.

By trial and error, you balance these 3 things by applying factors:

Throttle adjustment = kP*(RPM difference) + kI*I - kD* (rate of change of RPM difference)

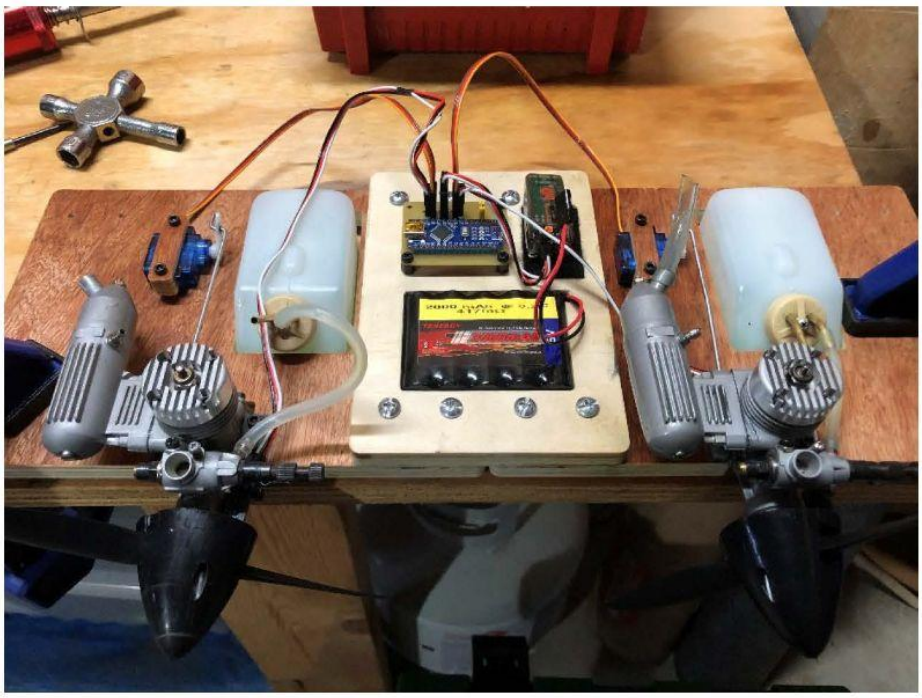
We don't need the error integral (accumulated error over time) in this application. Honestly, the differential factor is set so low that I'm not sure it's doing much either. Mostly the system adds a pulse correct proportional to how far apart the RPMs are.

About 20 times a second, the board looks at the RPM difference between the props and the rate at which that is changing and calculates what servo pulse correction to send to the engines. Empirically the kP value was 0.13 and kD value was .001 for my engines. Trial and error.

Construction Article (con't)

Results

I had a lot of things to learn on the way, but now it works! If you slow down one motor with a gloved hand on the spinner, the other one slows automatically in unison with the first. If either motor stops, the other one does too. The transmitter works just as it always did when the motors are running well, with the board making minor tweaks to keep the engines running as one. You can see the throttles auto-adjusting for big engine hiccups. If one engine stops, the code immediately outputs the minimum pulse width to shut down the other.



Since the prototype works, I've designed in some spare I/O pins for functions I might want in the future. For example, I could program an idle speed in RPM, then use another receiver channel as a kill switch. That would give me excellent predictability on a landing approach. Or, I could use a channel to switch the board in and out of setup mode, to save needed the setup mode switch on the plane.

The code does include diagnostics. The same USB port that is used to program the board is also a serial port. I have a routine that sends status information via the serial port during setup mode. It connects to a serial terminal app on an old phone via a USB cable. The phone reports whatever I want it to. Obviously, I display the RPM of each engine and I can add any data I want to that. The time it takes to send the data does delay the update of the throttle pulses maybe 100ms, but in setup I really don't care about that.

Now all I have to do is build a plane!

SCCMAS Work Party

By SCCMAS Member, Liam O'Connor

On November 6, 2024, a number of Tomcats modelers, led by Mike West (who are pictured below), participated in a work party at our field. The team completed much needed and long overdue repairs to the deck and underlying structure around the Shack. The SCCMAS is lucky to have committed club members with the talent and dedication required to maintain our infrastructure.

The contributions of our membership help to make our flying field one of the best in the nation. If you were unable to make our last work party, please try to make the next one, and be sure to reach out to our club leaders if you would like to contribute in any other way.

A HUGE thank you to the members that participated at the work party!!!

WARBIRD FLY-IN

Presented by the Santa Clara County Model Aircraft Skypark
SCCMAS "Tomcats" Field - Morgan Hill, CA

Saturday June 7th, 2025

Registration @ 9am

$15 Landing fee includes
Sandwiches & Soft Drinks

Warbirds of all types, sizes & eras!
Propeller, EDF, Turbine, gas, glow, JetA or electric welcome

Open to All AMA Members

Our access road from the freeway is gated. The gate will be manned until 09:30 to allow access for participants. Late arrivals will have to call the CD phone listed below to be let in.

MAP

www.sccmas.org

Contest Directors:
Lynsel Miller & Liam O'Connor (408) 641-8034

www.sccmas.org

AMA/FAA News

Please note that some of this may be new to you…

In addition to your SCCMAS Membership, you need:

- **A current AMA membership**
- **An FAA Small UAS Certificate of Registration**
- **Place FAA registration number on your aircraft**
- **Complete the AMA TRUST test**

The Recreational UAS safety Test (TRUST)
https://trust.modelaircraft.org/

FAA Drone Zone Website for Small UAS registration
https://faadronezone.faa.gov/#/

https://amablog.modelaircraft.org/amagov/2021/05/11/update-to-faa-drone-zone-registration-and-renewal-process/

FAA Recreational Rules: https://www.faa.gov/uas/recreational_fliers/

Advisory Circular AC 91-57B

AMA Safety Code

AMA Know Before You Fly https://www.modelaircraft.org/know-you-fly

Mark Your Drone

All drones must be marked on the outside with a registration number.

You can mark all drones that you own and fly exclusively under The Exception for Recreational Flyers with the same registration number.

Example FAA Small UAS Certificate of Registration

This Small UAS Certificate of Registration ***is not an authorization to conduct flight operations*** *with an unmanned aircraft. Operators of unmanned aircraft must ensure they comply with the appropriate safety authority from the FAA. To operate as a recreational flyer, a person must meet all of the statutory conditions of the exception for limited recreational operations of unmanned aircraft (49 U.S.C. 44809). Persons who do not meet all of the statutory conditions may not operate under the statutory exception for limited recreational operations of unmanned aircraft.*

For U.S. citizens, permanent residents, and certain non-citizen U.S. corporations, this document constitutes a Certificate of Registration. For all others, this document represents a recognition of ownership.

To fly under the exception for recreational flyers you must:

- *Have a current registration*
- *Fly only for recreational purposes*
- *Follow the safety guidelines of a community based organization*
- *Keep your drone within your visual line of sight*
- *Give Way and do not interfere with any manned aircraft*
- *Fly at or below 400' in controlled airspace and only with prior authorization*
- *Fly at or below 400' in uncontrolled airspace*
- *Comply with all airspace restrictions*
- *Pass The Recreational UAS Safety Test (Coming Soon)*

SCCMAS Members Meeting October 20, 2024

SCCMAS Members Meeting (con’t)

SCCMAS: Scenes from the Field

SCCMAS: Scenes from the Field (con't)

SCCMAS: Scenes from the Field (con’t)

SCCMAS: Scenes from the Field (con’t)

Above and Below: Bob Zuk’s SIG Astro-Hogs. Covered with Oratex fabric, with O.S. 2 stroke gasoline engines

SCCMAS: Scenes from the Field (con't)

SCCMAS: Scenes from the Field (con't)

Below: Antonio Counsel (R) celebrating the successful maiden flight of his E-Flite 90mm Viper that he converted to turbine power (Xicoy X45 engine), via Paul Appelbaum conversion kit. Alex Saroyan (L) assisted Antonio with the maiden.

SCCMAS: Scenes from the Field (con’t)

Below: San Jose State Aeronautics Team flies their scratch built plane for a competition. Test flight by Norio Eda.

SCCMAS: Scenes from the Field (con’t)

Below: San Jose State Aeronautics Team prepares the Second Version of their scratch built plane for a test flight.

SCCMAS: Scenes from the Field (con't)

Below: The jet that Roger "zigged" instead of "zagged"!

SCCMAS: Scenes from the Field (con't)

Below: SCCMAS Member, Matt Campi, spotted the rattlesnake pictured below in late March, as we were experiencing our first spring weather of the year. Matt wrote: *"I first saw this guy about 6" from my toe when I was locking the gate. He was very unhappy with my presence. Everyone needs to be vigilant at the field as this year, as we apparently have an overabundance of rattlers!"*

Sheldon’s Hobbies: New Location

Below: Sheldon’s Hobbies is moving from its current location on Tradezone Blvd in Milpitas to its new location in Willow Glen, at 1153 Lincoln, San Jose, CA 95125

Servo Chatter is published several times annually by the SCCMAS "Tomcats" radio control club located in Morgan Hill, CA. Views expressed in Servo Chatter are those of the writers. They do not necessarily represent the views of the club, its members, or officers. Mention of any product, material, or service shall not, nor is it intended to, imply approval, disapproval, or fitness for any particular use. The SCCMAS is a non-profit organization. Permission is granted to reproduce anything printed in Servo Chatter as long as the source and author are credited.

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