EL TORBELLINO

NEWSLETTER OF SAN DIEGO ORBITEERS FREE FLIGHT CLUB

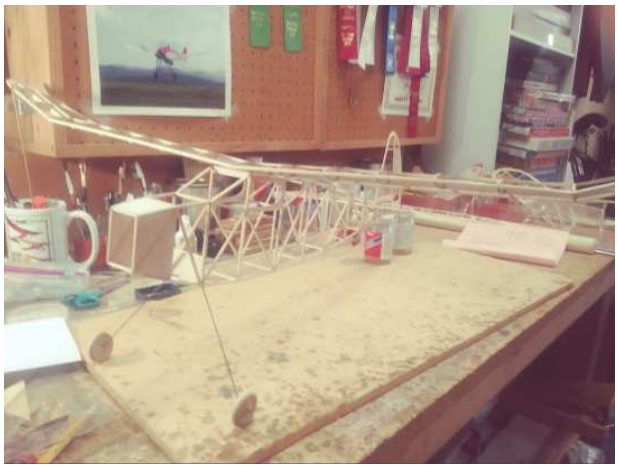
SEPTEMBER 2022

Chairman's Corner – Mark Chomyn

As we roll into September, we've seen some unsettled atmospheric conditions (darn weather) and some sizzling temperatures. This last weekend Hurricane Kay came up the coast from Baja with much fanfare from local and national meteorologists. On the coast here in Encinitas we got about 6/10ths of an inch of rain but folks to the east and in the mountains saw up to four inches in some areas. So, though the big dump was a big dud for my lawn, it was troublesome enough to create some event cancellations.

The most disappointing of those cancellations was the two-day Scale Staffel event at Perris on Sept. 10 and 11. In addition to rain, the forecasted high winds and potential lightning put a damper on the contest. Keep your eye on your email and the El Torbellino for a new contest date. I started to prepare for the contest on Friday (9/2) of the week before the contest. I started getting planes ready and when I went to replace motors, I discovered that I didn't have an adequate supply of either 1/8 of 3/16 rubber. I immediately made an online order with FAI Model Supply and hoped that the delivery would be timely. While waiting I received the contest cancellation email. That took the worry out of the rubber delivery which as fate would have it didn't happen until Saturday (9/10) afternoon. Too late for the first day of the contest. However, I had made up my mind prior to the cancellation to show up anyway and just work with the rubber that was already in each plane by applying generous motor lube and backing off on winds. So, the contest cancellation though disappointing was beneficial in my case.

As for upcoming contests, the next Orbiteers outdoor will be September 25 at Taibi Field in Perris. Events will be Old Time/Nostalgia, Glider and Power. Get your planes and flight gear ready and we'll see you there.



With regard to Old Time, my goal of flying anything but a Gollywock continues. The Best-By -Test Stratometer turned out not to be a fly- right-off-the-building-board success. It test-glided OK but would auger-in on power. So, I started construction on an Ace Whitman Albatross. A 36-inch span high wing cabin type model that looks like a Miss Canada/Jabberwock cross-breed. It's all framed up and ready to cover and I've got another two weeks to finish it. I think I can make that work. But if this experiment fails, I will reluctantly drag a Gollywock plan from my stash and stop beating my head against the wall.

If you got your September issue of Model Aviation, you may have noticed an article on page 14. It announced an increase in AMA membership dues. Reasons cited were supply chain disruptions and inflation (causing increased paper prices), an increase in insurance costs and expenses for AMA lobbying on the FAA reauthorization in 2023. The article mentions that if you buy a 3-year renewal the cost per year is equivalent to the current yearly cost, but you pay more upfront. The article mentions that AMA has not raised yearly dues costs for seven years. So, I'm going cut them some slack.

Continued Next Page

Also, in Model Aviation on page 6 it asks for readers to submit their idea on what would be their vision of a perfect issue of Model Aviation. Well for me that would be one that looked a lot like an issue of Flying Models (FM) in the 1950's and 1960's when free flight models and plans were seen on a regular basis, from designers like: Paul Del Gatto, Paul Plecan, Bill Dean, Carl Goldberg, Sal Taibi (remember the Stardusters?), Woody Blanchard and Don McGovern. Sending that reply to AMA would probably relieve some of my anxiety about the AMA dues increases but I'll just go out in the garage and pull a few classic issues of FM from my collection and reminisce. It's less likely to cause controversy.

In a past article, I mentioned the passing of Lee Hines a notable glider designer and glider flying champion. I recently received an email from Tim Batiuk about his experience at this year's AMA Nationals glider events. In that email Tim mentioned that a service was performed in Lee's honor on "hand launch glider hill" at the Nationals. Not only were Lee's ashes released from a rocket glider some 40 people in attendance also got to spread some ashes on HLG Hill. A nice and well-deserved tribute to Lee.

On a similar note, I got an email from the SCAMPS announcing the 2023 Sal Taibi Fun Fly. This will mark the 10th anniversary for the fun fly first held on January 2013. Mr. Taibi was a pioneer and legend as a free-flight designer and flyer. To list his accomplishments, contributions and to document his involvement in the advancement of free flight would literally take a book. So, save the date, Sunday, January 8, 2023. Check the SCAMPS website for specific classes to be flown.

That's a wrap for this month.
Mark

"You cannot propel yourself forward by patting yourself on the back."
Steve Prefontaine – Olympic long-distance runner

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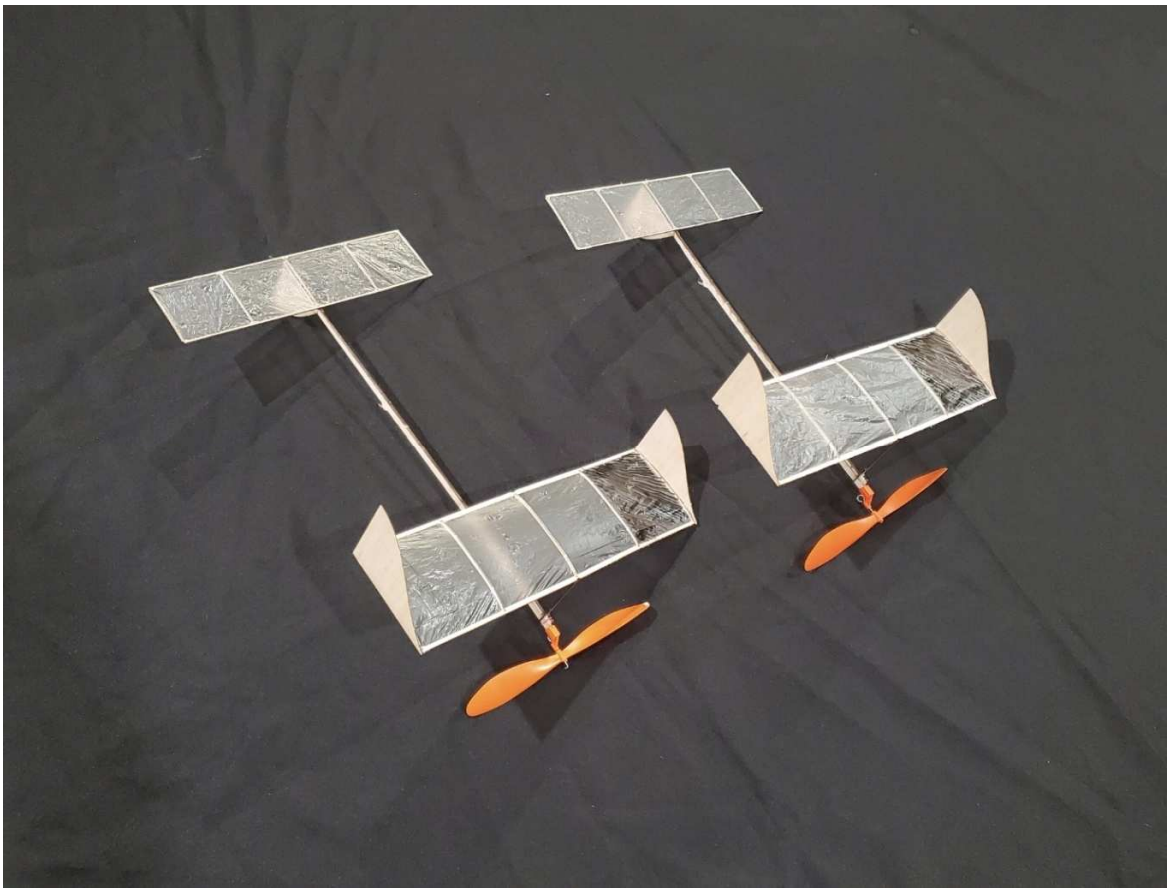
Science Olympiad Flight Event for 2023
By Mike Jester

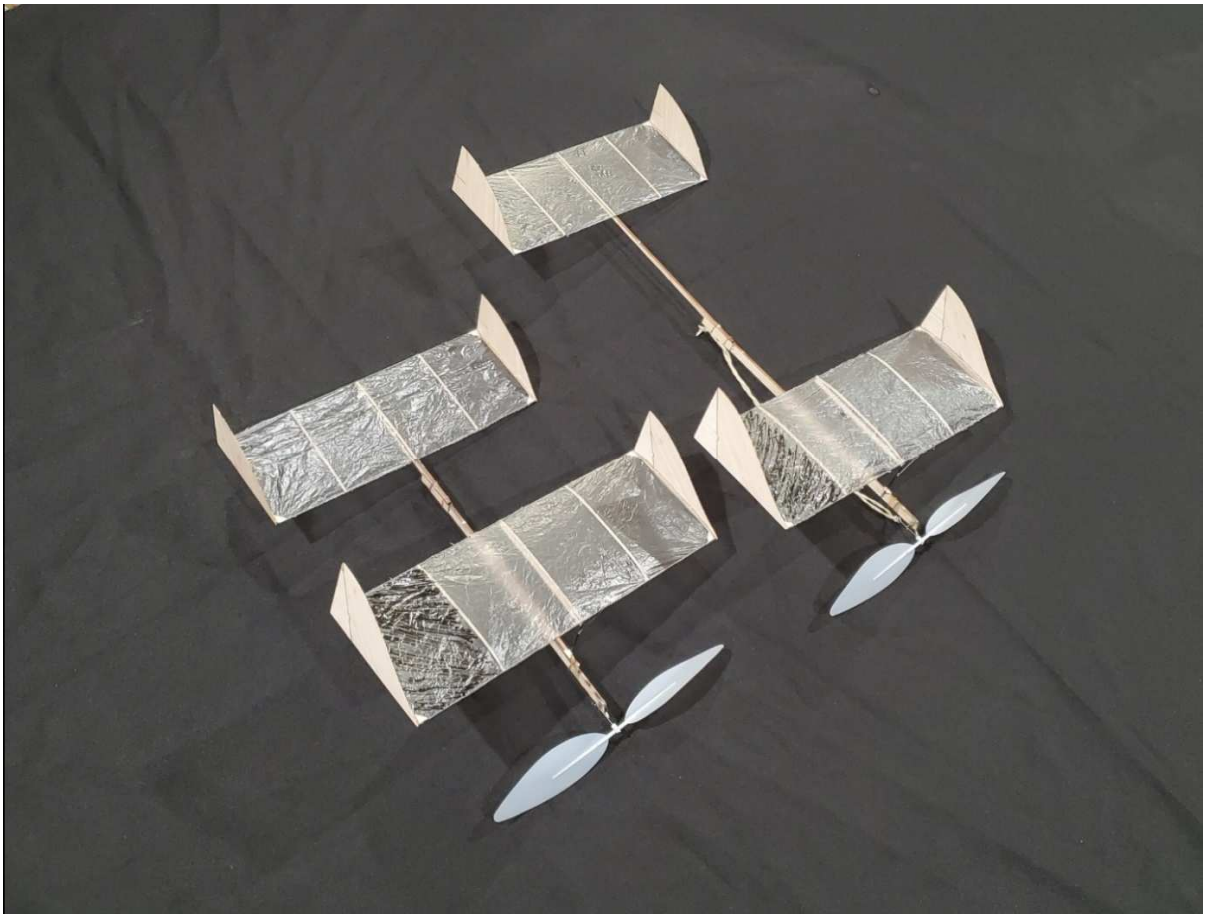
Science Olympiad is a nationwide contest in which teams of 15 middle school students (Division B) and 15 high school students (Division C) representing their schools compete annually against one another in the spring. The competition includes approximately 23 testing and building events. The object of the competition is to promote STEM education. For over three decades Science Olympiad has included an indoor flying event, either rubber powered airplanes, catapult launched gliders, or rubber powered helicopters. Prior to this year, the airplane event has always been called "Wright Stuff." Many students and adults, including myself, first became serious about rubber powered free flight as a result of participating in, or coaching, the Wright Stuff event. Indeed Kang Lee, a two- time F1D world champion and Orbiteers club member, got his start in indoor rubber powered free flight coaching students in the Wright Stuff event. This past year I was the Event Supervisor for the Wright Stuff Division C event in the Southern California State finals held in April and for the Wright Stuff Division C event in the National finals held in May. The top high school competitors had spent many hours building and practice flying, and it would have been hard for even the most accomplished adults to beat these fliers.



Division B (left) and Division C (right) Senior Flyer Models from J & H Aerospace

After those Wright Stuff competitions were completed, I was part of a committee tasked with revamping the rules which resulted in the new "Flight" event. Under the Division C rules, a rubber powered airplane must fit inside a Banker's Box in its ready to fly condition. Under the Division B rules the box is slightly longer. The airplane must weigh no less than 8 grams and its rubber motor must weigh no more than 2 grams. Bi-planes, pushers, canards, and twins are all permitted under the new rules. For several years I had promoted

the “fit-in-a-box” rule to speed up the check-in. Under the old Wright Stuff event there were strict span and chord limitations for the wing and stab, and a prop diameter limitation. It was cumbersome and time consuming to measure students’ planes. The dimensional limitations also stifled creativity and led to cookie-cutter airplane designs. Another benefit of the “fit-in-a-box” rule is that it promotes safe storage and transport of student models. J & H Aerospace is selling two different kits for building models that meet the 2023 Flight event rules. The Senior Flyer, pictured above, has a simple balsa wood frame construction and a molded plastic prop. The Stinger, pictured below, utilizes carbon fiber spars and a lightweight Ikara prop. The wing and stab of the Stinger models have larger chords than the simpler Senior Flyer design. Joshua Finn says that the Senior Flyer will produce flights approaching two minutes while the Stinger will produce flights over two minutes.



Division C (left) and Division B (right) Stinger Models from J & H Aerospace

Let’s hope that our club secures an indoor flying site this year so that we can mentor some students in the new Science Olympiad Flight Event. They are the future of our hobby.

GLDERLPALOOZA

Back in early July Mike Pykelny told me he had an inspiration for a new glider event that he wanted to hold at the August Orbiteers' contest. It was going to require that three flights be made between 8:30 and 9:30, and another 3 flights would have to be made between 9:30 and 10:30. Some more rules were fleshed out: Any combination of HLG and CAT could be used. Maxes were to be 90 seconds. All flights would count. And anyone that launched between their legs would get a 3 second bonus.

The Orbiteers' don't normally schedule a contest for August, due to the tremendous heat. It turned out that they were right, all of us died of heat stroke and I am writing this posthumously. Mike's idea, and Tim Batiuk's hard work, along with their generousity, resulted in 8 glider fliers putting in all 6 flights for the first ever GLIDERPALOOZA.

The contest began with the very aggressive tone of Stan shouting, ROUND IS OPEN. No one launched immediately, preferring to wait for some other poor fool. Chris Reck flew cats for all flights, Stan flew them for the first 3, everyone else flew TLGs. The drift was minimal all morning, chases could be done at a saunter pace. Thermals were very weak. Chris, kindly, had set up two very tall streamer poles, and put up with others telling him where he should move them. Tim spent most of his time helping fliers with gliders and throwing tips. It worked, fliers had a good time and some of us improved.

HIGHLIGHTS

Junior Daniel Guo, just beginning TLG, is already throwing so well that he will soon be a threat to win. John Merrel, also a recent glider participent, showed a shocking increase in his throwing skills and took 3rd place! Chris Reck continued to launch higher and better than any other catapult flier. This skill propelled him to 2nd place. Stan, picking none of his own air, floated to first and the extra big payout of $40! All other fliers launched and glided well enough that they could have won, the level of competition was very high. Tim, the usual winner, had the bad luck of a stab breaking off on launch through no fault of his. Since all flights counted this put him out of the running.

One last highlight: Mike Pekelny's coupe, in a very light thermal, taking its bloody time to drift near the glider launch pen. Mike, I hope you keep thinking about all of us and how to make Orbiteers' free flight better. Thanks!

Orbiteers
SAN DIEGO

AE-24 2022

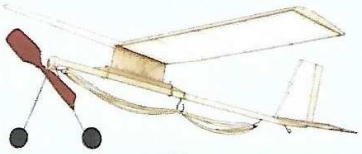
A Model Aircraft Competition Just for College Students

Eligibility to Enter

1. **No entry fee**
2. One flight per entry, Longest time wins *(see bonuses below*)*
3. This competition is open to any university or community college student ages 18-25 in the United States. College ID or proof of enrollment is required.
4. Submit a video or video link of the flight to the NFFS AE24 Competition Director: ross.jahnke@nicholls.edu. Please put AE24 in the subject line.
5. *Entrants need not be members of the Academy of Model Aeronautics (AMA) or the National Free Flight Society (NFFS) to enter.*

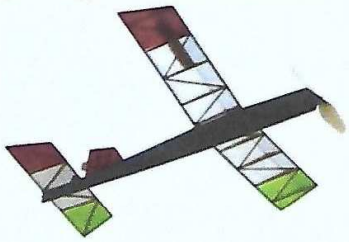
Aircraft Specifications

1. This *Free Flight* model may be from a kit, published plans, or of your own design; be creative!
2. Wingspan shall not exceed 24 inches (61cm) when it is in assembled condition. The wing is the largest flying surface on the model no matter the configuration. Fuselage length is not limited. The flying surfaces shall provide the sole source of lift (no balloons etc.), and may be made from foam, balsa, and/or tissue paper.
3. The propeller shall be an unmodified commercially available plastic freewheeling propeller up to 8.5 inches (22cm) in diameter. Weight may be added to balance the propeller. The propeller will be the sole source of thrust for the model.
4. A wound rubber motor shall be the sole means of energy to turn the propeller (No R/C, electric motors, engines, catapults)
5. Flights will be timed from the moment the model is launched to the time it lands, measured in seconds.
6. ***NEW for 2022: Bonuses for balsa and tissue construction.**



a. Final score will be flight time multiplied by 125% for all balsa wood or balsa wood & tissue airplanes with a stick fuselage. No foam flying surfaces.

a. An example of a model with a stick fuselage, & balsa and tissue wings.



b. Final score will be flight time multiplied by 150% for all balsa wood or balsa wood & tissue airplanes with a built-up fuselage, where the rubber motor is inside the fuselage. No foam flying surfaces.

b. An example of a model with a built-up fuselage, where the rubber motor is inside the structure.

Prizes

1st Place - Apple iPad WiFi 64GB
2nd Place - One by Wacom, Medium Graphics Drawing Tablet, 10.9 x 7.4 inches
3rd Place - One by Wacom, Small Graphics Drawing Tablet, 8.3 x 5.7 Inches
Sponsored by the National Free Flight Society https://freeflight.org/join-learn-fly/nffsu/

NFFS
NATIONAL FREE FLIGHT SOCIETY

FINISHING CATAPULT AND HAND LAUNCH GLIDERS

by Stan Buddenbohm

Many expert modelers have their own opinion about the best finish methods. This short article is not about trying to convince you of what is best. The following methods work, hopefully you will find them useful.

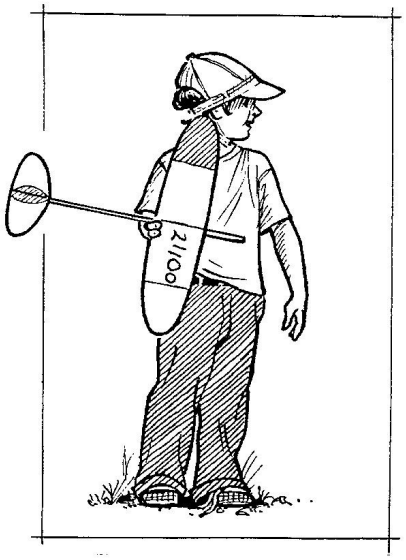
INDOOR: Under about 60 ft bare balsa is common. Balsa tends to have fuzz that causes too much drag. Sand it a bit with 220 grit (Always use top quality sandpaper) and then sand as slick as practical with 600 grit wet or dry sandpaper. Finally use the back of the sandpaper and pretend like you are sanding the surface again. This is called burnishing and will help get rid of fuzz and dust. That's it. Over 60 ft the model can be finished with outdoor methods but do so with weight in mind – maybe just one coat, or thinner coats, of polyurethane (see below).

OUTDOOR: Prepare the balsa as described for indoor. If the balsa is not slick coats of finish won't be satisfying. MinWax Helmsman Spar Urethane is the best material for this. Use the oil based version. Due to environmental zeal some States now require it to be water based. The water based version soaks into bare balsa and becomes too heavy. If that is all you can get then you need to put some type of light sealer on the bare wood first. Then the water based version will spread far, be light, and have other good qualities.

Put on a pair of disposable nitrile gloves. Fold a QUALITY paper towel several times into a useful size, say 1.5" x 5". Use a small foam brush, a .5 x 6 x .125 balsa scrap stick, or just the paper towel to dip some urethane out of the can and onto the balsa. Spread it as far as you can with the paper towel. You are not trying to rub it off but the surface should not be "wet" either. Repeat to cover the entire surface. Let it cure for a few hours, or even days if you want to. Sand with 600 grit. Don't go overboard, you are not trying to sand down to the balsa, just getting rid of bumps and making it fairly slick. Now repeat for a second coat. That's it. You now have a waterproof, fairly light, slick enough, durable finish.

If you want to color the model use Ken Bauer's technique. Get Design Master spray paint (you can find it at Michael's, or similar, craft stores) and go as nuts as you want. It is very light, dries very fast, comes in many colors. You can use it between coats of urethane or over the last coat. Sand it a bit with 600 grit.

Orbiteers
SAN DIEGO



DUAL-CLUBS
FREE FLIGHT BONANZA

A National Cup Points Event

CLASS AA, CATEGORY 2
SAN DIEGO ORBITEERS 63rd ANNUAL - SPONSOR OF AMA EVENTS
*
FRESNO GAS MODEL CLUB 82nd ANNUAL - SPONSOR OF NOSTALGIA, TEXACO & OLD TIME EVENTS

* November 12th & 13th, 2022 *
* LOST HILLS, CA *

SATURDAY ONLY *7 AM – NOON, 1 - 5 PM* ***LUNCH BREAK W/ ICE CREAM SOCIAL***	***EITHER DAY*** ***MUST FINISH EVENT THE SAME DAY***		***SUNDAY ONLY*** *7 AM – 3 PM*
A GAS	SMALL OT RUBBER STICK/ CABIN COMBINED	.020 REPLICA	1/2A GAS (1)
C/D GAS	LARGE OT RUBBER STICK/ CABIN COMBINED	A/B PYLON/FUSELAGE COMB	B GAS
E-36	½ A NOSTALGIA	C PYLON/FUSELAGE COMB	A/B ELECTRIC COMBINED
P-30 (1)	A/B NOSTALGIA COMBINED	RUB/WAKEFIELD NOS	HAND LAUNCH GLIDER (1)
VINTAGE FAI POWER	C NOSTALGIA	CLASSIC TOWLINE	VINTAGE WAKEFIELD
CATAPULT GLIDER (1)	EARLY ½ A NOSTALGIA	½ A CLASSIC POWER	FULL SIZE TEXACO
½ A TEXACO		½ A GOLDEN AGE	MULVIHILL
DAWN P-30 MASS LAUNCH		1 MINUTE TARGET	DAWN MULVIHILL
NIGHT GAS (COMBINED)			GOLLYWOCK MASS LAUNCH
TWIN PUSHER MASS LAUNCH			

(1) Junior & Senior/Open Event ***See Special Instructions on backside***

***** AN ORBITEER TRADITION LIVES ON *****

JOIN US FOR SATURDAY ICE CREAM SUNDAE SOCIAL ON US (NOON – 1 PM)
also

SATURDAY NIGHT FOOD FEST POTLUCK ORGANIZED BY DAN HEINRICH (6:00 -7:00 PM) *(Main course provided)(Bring a side dish or dessert)*

CASH AWARD FOR 1st PLACE with 3 or more entries. Certificates awarded to 1st,2nd & 3rd place

Ceremonies at: 3:15 PM Sunday

$20 REGISTRATION Sr. & Open / $2 Jr, includes 1st event

$5 per Event Sr. & Open / $1 Junior -
Optional: $40 for Registration & Unlimited Events

For Information Contact:

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(858)774-2941
dbartick@4-warddesign.com

NOS/OT: Doss Porter, Fresno GMC
(559)-251-0787
Steve93612@comcast.net

SPECIAL INSTRUCTIONS

(LOST HILLS FF MODEL AIRFIELDASSOCIATION CARD REQUIRED ($25 AT FIELD TO JOIN)

SATURDAY NOON to 1 PM LUNCH BREAK & SUNDAE SOCIAL

The contest will be suspended for 1 hour for lunch and the San Diego Orbiteers famous ice cream social. This is a great time to relax, cool off, have lunch and enjoy the ice cream sundaes. We will provide ice cream, & sundae fixings, napkins, plates and plastic ware.

PRIZE DRAWING

The Fresno GMC once again has collected an enormous amount of model stuff for their drawing. For up to 3 events entered that are sponsored by them, the contestant will receive a drawing ticket. Drawing to be held right after Sunday's award ceremony.

BILL BOOTH, SR. MEMORIAL

High time in Old Time Gas. Includes 020 Replica; but not Texaco. Winner will receive a special award from the Fresno GMC.

HAND LAUNCH GLIDER & CATAPULT GLIDER

Hand Launch Glider & Catapult Glider will to be launched from an established glider pen on the field. Max's are 120 seconds and all flights count.

NIGHT GAS FLYING

All engine classes combined. Event window between 6:30 pm – 9pm. Engine runs in accordance with aircraft classification; i.e., AMA or Nostalgia.

VINTAGE FAI POWER

For rules, please go to this website: *https:// freeflight.org/wp-content/uploads/2020/12/NFFS-Competition-Rules-2021-2022-Release-3.pdf* A copy of the rules will be available at the CD's table. *First five (5) flights must be flown from the established line between 7:00AM – 12:00 PM.*

VINTAGE WAKEFIELD

For rules, please go to this website: *https:// freeflight.org/wp-content/uploads/2020/12/NFFS-Competition-Rules-2021-2022-Release-3.pdf* A copy of the rules will be available at the CD's table. *First five (5) flights must be flown from the established line between 7:00AM – 12:00 PM.*

DAWN P-30

Saturday morning 7:30 AM sharp. Mass launch from glider pen; 1 flight, no max.

DAWN MULVIHILL (Timer can ride with contestant)

Sunday morning 7:30 – 7:50 AM launch window, 1 flight, no max.

TWIN PUSHER MASS LAUNCH

Saturday morning 8:30 sharp. Mass launch from glider pen; 1 flight, no max.

GOLLYWOCK MASS LAUNCH

Sunday morning at 8:00 sharp. Mass launch from glider pen; 1 flight, no max.

TEXACO (Timer can ride with contestant)

1 MINUTE TARGET

Any Sport Plane, such as: Dakota, Sniffer, Tom Boy, Sioux. Even Peewee 30.

6 official flights. All count. Fight duration must be equal to or over 1 minute. Score will be the number of seconds over 1 minute for each of the 6 official flights. Flights under 1 minute will be an attempt. No limit on attempts. Lowest total of 6 official flights wins. **Note:** Use of DT will be allowed for flights that exceed 3 minutes. DT at less than 3 minutes will be an attempt.

JULY / AUGUST 2022
MONTHLY RESULTS
By M.Pykely

10-Jul

P-30	Don
	Clint
	John S
CLG	Chris
	MP
HLG	John M
	Brad
	Clint
Power	Don
	MP
	John S

14-Aug

COUPE	Mike
	John S
	Mark
Power	Clint
	David W
HLG	John M
	Tim
	Clint
CLG	Chris

ORBITEERS MEMBERSHIP DUES

Annual Membership - $20
Lifetime Membership - $250
Non-Member Newsletter Subscription - $15
Junior Members 16 years old or younger - Free

Submit Dues to Club Treasurer:
Howard Haupt
3860 Ecochee Avenue
San Diego, CA 92117-4622

THE FINE PRINT THE FINE PRINT

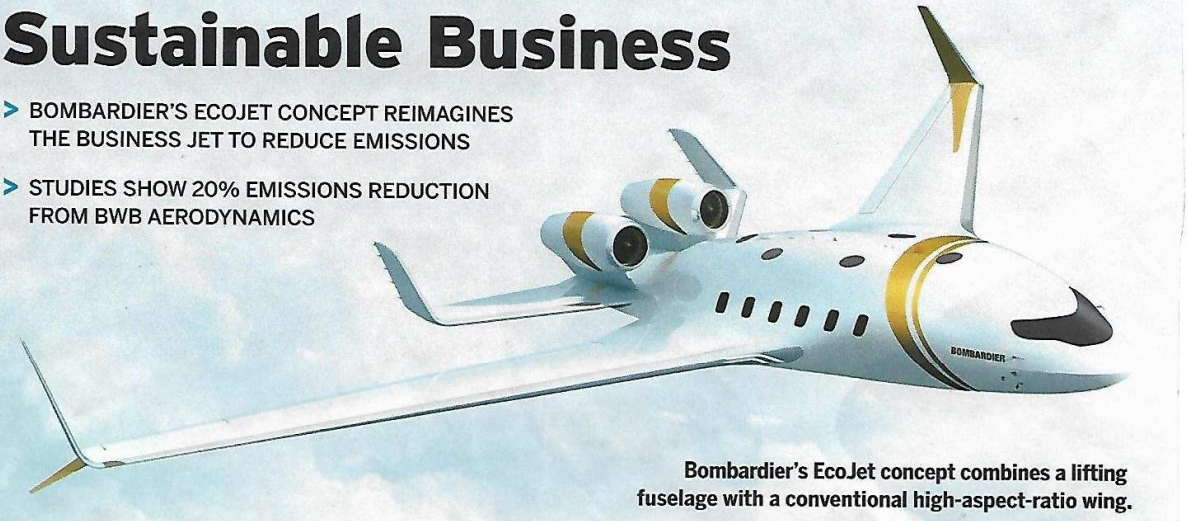
ORBITEER WEB SITE

www.SanDiegoOrbiteers.com
Webmaster: Kathy McLaughlin

Sustainable Business

> BOMBARDIER'S ECOJET CONCEPT REIMAGINES THE BUSINESS JET TO REDUCE EMISSIONS

> STUDIES SHOW 20% EMISSIONS REDUCTION FROM BWB AERODYNAMICS



Bombardier's EcoJet concept combines a lifting fuselage with a conventional high-aspect-ratio wing.

BOMBARDIER

Graham Warwick Washington

CIVIL AVIATION has committed to deep cuts in its climate impact, but not all industry sectors have the same technology options. Zero-emission hydrogen propulsion, for one, shows promise in commercial aviation but is less suited to business aviation's unique needs for range, cabin size and airfield access.

Bombardier is maturing a range of technologies with the goal of supporting business aviation's target of achieving net-zero carbon emissions by 2050. A key part of its efforts is the exploration of aircraft configurations that could offer substantial reductions in fuel consumption.

The Canadian business-jet manufacturer has flown a 7%-scale model of a blended wing-body (BWB) design with the aim of halving emissions through a combination of aerodynamic and propulsion improvements. A model twice that size is planned to fly this year, and a bigger version may follow.

Bombardier's EcoJet project emerged from a Canadian research program, the Green Aviation Research and Development Network (GARDN), which ran from 2009 to 2021. Under GARDN, Bombardier and its partners explored application of the aerodynamically and structurally efficient BWB configuration to a 100-seat regional jet.

"We've been at this for almost 10 years, and we've progressed the configuration a fair bit," says Benoit Breault, Bombardier's director of research and technology. "We've done mockups of what the interior would look like. We've done flight test on the scaled vehicle. Now we're moving on to a slightly larger vehicle.

"So far we see that pure aerodynamics—not even mixing it with new propulsion technology or lighter materials—will probably give us a drag reduction of up to 20%. On an actual vehicle that will turn directly into a fuel-burn reduction," he says.

"It could be more, but we are not super-aggressive on the shape of the blended wing body. That's a conscious design decision because going too aggressive compounds the technological gaps and risks," says Breault, who is responsible for maturing the technology portfolio Bombardier will need in 10-20 years and its conceptual design teams working on future aircraft.

"We like to think our shape is slightly blended. It means our prediction of 20% is a really good return on the technological risk we are willing to take," he says. Compared with BWBs from Boeing and Airbus, there is less blending of the fuselage and wing, which reduces wetted area and therefore drag.

The GARDN project showed that, as a BWB is scaled down, the body contributes a greater proportion of the total lift, but does so less efficiently than the wing, so overall efficiency suffers. The studies showed a 100-seat BWB had a slightly higher fuel burn than an equivalent tube-and-wing design.

Under GARDN, aerodynamic shape optimization was performed to identify alternative BWB configurations with better aerodynamic performance. The result was a design with a more slender lifting centerbody and distinct wings. The EcoJet concept has a similar configuration, combining a lifting fuselage with a high-aspect-ratio wing and rear-mounted turbofans shielded by a U-shaped tail.

"We don't blend as much, which reduces the wetted area, and that's a big part of the drag reduction," Breault says. "And we are very fond of the highly loaded, high-aspect-ratio wing and its high-lift features because we believe that brings a level of additional protection when it comes to stall characteristics.

"A traditional tube and wing has maybe 5-10% of its lift from the fuselage. In our EcoJet design, we estimate up to 30% of lift comes from the body, so we can reduce the size of the wing. And because we are still fond of high-aspect-ratio wings it's an interesting mix of the two technologies," he says.

There are challenges to be over-

LOGO: ARTHOBBIT/UNDEFINED UNDEFINED/WASTESOUL/MARYLOO/GETTY IMAGES

come with a BWB design. "We keep future certification regulations in mind," Breault says. "One is passenger egress. That was one key concern we have been able to reassure ourselves is in a good place when it comes to certification."

Another concern is headroom across the cabin, as the fuselage is not tubular. "You have amazing headroom in some areas but, because the fuselage tapers more aggressively at the aft end than what we're used to, we had to validate that the usable volume is reasonable based on our layouts," he says.

Rather than exploit the BWB configuration to increase cabin size, Bombardier constrained the design to a usable volume equivalent to that of its Global 6500 large-cabin, long-range business jet. "We've been able to reassure ourselves through the full-scale mockup that the inner mold line, or interior volume, we are planning is absolutely usable for our cabin layout," Breault says.

Managing center of gravity (CG) movement is another challenge. "For the static CG, when the aircraft is on the ground, you want to make sure it doesn't tip over," he says. "Then the CG moves as you burn fuel in the cruise. You want to make sure you have a reasonable envelope for usable CG. That is still a challenge [for the EcoJet] that is not fully solved today."

The noncircular pressure vessel is another issue. "That is one of the knowledge gaps we have to figure out by the end of the decade, so it's on our [technology readiness level] 6 road map," Breault says. One complicating factor is Bombardier's "negative experience" with all-composite airframes on the canceled Learjet 85.

"You can imagine that is a big part of the conversation we are having internally," he says. "We've done conceptual studies and are carefully studying the types of material technologies we're going to need for the fuselage. But we're not sure that Bombardier will be the one owning the fuselage technically. We are likely to be looking at partnerships for developing the pressurized fuselage."

Another concern is whether a BWB lends itself to a portfolio of aircraft. With Bombardier's Challenger and Global families, "you can go from 4,500 nm to 8,500 nm," Breault says. "If we were to go with a blended wing body, where would we start in that spectrum and what would the scaling look like?" he asks.

"That's one aspect that we have not figured out. In aviation, you develop a new model, then all you do is derivatives, other family members. We are not sure how we're going to scale that type of fuselage to either larger or smaller vehicles," he acknowledges.

"That's a big concern we are trying to find solutions for, because it will change the economics of airplane development. We want to go that way [the BWB], so the benefits really have to outweigh the risks [on this issue]," Breault says.

Bombardier also expects that the BWB is not the right approach for all classes of business jet. "The shorter-range aircraft in our portfolio are probably going to stay tube-and-wing," he says. "Those are the primary candidates for novel tail cone technologies for ingesting and reenergizing the boundary layer. We think there is quite a bit of drag reduction that can come from those."

But for longer-range aircraft, Bombardier projects that it can get a 20% emissions reduction from BWB aerodynamics and another 20% from hybrid propulsion. "If we can get another 10% from lighter structures we're halfway [to net zero], and we think the other half will come from [sustainable aviation fuel (SAF)] and [carbon] credits," Breault says.

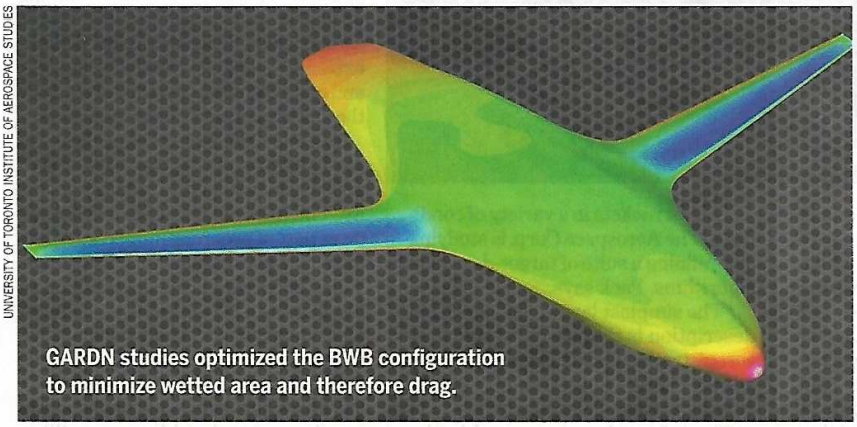
Bombardier does not consider hydrogen a viable option for business aviation, except perhaps in fuel cells powering subsystems. "We see too many problems and not enough benefits," he says.

Gaseous hydrogen storage requires too much volume, and liquid hydrogen introduces cryogenic systems. "Then that's another technology we have to mature to be able to carry on," Breault says. "And we don't think hydrogen is going to be widely available at the airports business aviation operates from." Also, hydrogen combustion still generates nitrogen oxides (NOx) and contrails. "We don't think it's sufficient to only get rid of carbon," he notes. "Why would we spend 20 years developing the technology and still be emitting NOx?"

For now, along with SAF, the BWB is Bombardier's bright hope for future sustainable business aviation. As a next step, the company is considering building a large EcoJet demonstrator to further mature the technology and reduce development risk.

"Industry has not yet found common ground on the scaling laws from subscale flight testing to full scale. It's a complex challenge, and we are exploring building an even larger model, 40-50%-scale, to gather enough data to give us the confidence in the vehicle," Breault says.

"We need to determine as fast as we can whether this configuration is viable, because the business is going to make long-term plans with this configuration. And if we're going to find technical issues that will make the project not viable, we need to find them as soon as we can," he says. "Today we have not found those major issues, and until we find them, we allow ourselves to believe."



UNIVERSITY OF TORONTO INSTITUTE OF AEROSPACE STUDIES

GARDN studies optimized the BWB configuration to minimize wetted area and therefore drag.

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WHAT'S HAPPENING - September / October 2022

September 25 San Diego Orbiteer Outdoor Monthly
Taibi Flying Field, Perris CA, 7:30 am.
Events: **OT-NOS RUBBER / Glider / Power**

October 16 San Diego Orbiteer Outdoor Monthly (Rain Date: Oct 23)
Taibi Flying Field, Perris CA, 7:30 am.
Events: **P-30 / Glider / Power**

November 12, 13 **Dual Club Annual Contest, Lost Hills, CA**
(See enclosed flyer for contest details)