EL TORBELLINO

NEWSLETTER OF SAN DIEGO ORBITEERS FREE FLIGHT CLUB

DECEMBER 2024

Chairman's Corner – Mark Chomyn



Seems like only yesterday that I devoured my Thanksgiving turkey and Christmas is just around the corner. The best thing for me as a kid was knowing that at least one of the presents I received on Christmas would be a model plane kit. My parents knew I was nuts about flying model planes even though some of the kits I built weren't exactly masterpieces. After all the presents were opened, I'd take the model kit I received over to the coffee table in the living room in front of the TV. I'd open the kit box and deeply inhale the aroma of balsa wood. Next came unfolding the plans and staring at them and imagining my plane coming out as neatly as the picture of the plane on the box cover. Then immediately going for the straight pins in my Mom's sewing supplies, grabbing a tube of Ambroid, placing a sheet of wax paper over the plan and starting work. My parents (who really didn't care for the smell of glue) would ask why I wasn't tackling my project down in the cellar. My usual reply was that I liked to build in front of the TV. Those were the days!

I was hopeful that this year the best gift I (and the Orbiteers) would receive would be the use of a gym on the Mira Costa College campus in Oceanside. A meeting with a facilities representative went well and they didn't see that our indoor flying would create any concern about damage to the gym floor. A request for gym use was submitted to the college "Facilitron" reservation scheduling site. One day later I received an email from Mira Costa facilities indicating a reservation had been booked for January 5, 2025 and the cost for booking was $170.78. Wow, that seemed very reasonable. If we could get at least 8 or 9 flyers who were willing to pay $20 we could cover the bill. I quickly got out my credit card and paid up. Two days later I received a call from Mira Costa facilities. They were calling to inform me that there was $285 in additional fees (janitorial, bathroom use etc.) that needed to be paid. The air left my balloon instantly. These fees were similar to those we faced when we tried to renew our gym use at Grossmont College. That would raise costs person for 10 flyers to $45 each. Given that, we won't pursue the gym rental any further.

Though we don't have a gym for indoor flying we still have the Taibi Field in Perris for our outdoor monthly flying. The date for our December outdoor event is December 15.
It's listed as a makeup contest on the flying schedule on our website. We've only flown OT/Nostalgia Rubber three times this year compared to four for P-30 and Coupe so my guess is the main event will be OT/Nostalgia (but look for an event email to confirm) along with the other regular events for glider and power. I will be the CD for the event. I haven't had the opportunity to travel down the temporary access road route, but I've been told it was successfully traversed with a Prius. My Camry is rather low to the ground but weather permitting I'll give it a go.
See you there.

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If you'd like to start year 2025 in a competitive spirit, the SW Regionals will be held from Jan 18 – 20 at Webster West Field in Eloy AZ. You can bask in the Arizona sunshine while flying a variety of events including P-30, small and large rubber stick or fuselage, WWI and WWII mass launch and glider events. Safe travels and thermals to all those fliers making the trip.

To wind it up, (no pun intended), on December 4th Orbiteers, Mike Pykelny, John Merrill, Don Barick and I had the pleasure of being timers for Gary Fogel's Aeronautical Engineering class at San Deigo State University. Students flew AMA Alphas and we timed their flights. Compared to last year's event, the students this year had better flight times and probably spent some time trimming their models before the class event. Several students I timed had planes that left the flying field unfortunately one model landed on a roof top. Best time for my group of fliers was about 46 seconds. Not bad if you ever seen an Alpha. They're not high performance ships. We will be assisting as timers again in the spring of 2025.

Happy Holidays to all.
Mark

"We were in complete ignorance of balance and trim procedures, so our efforts normally ended up as display types rather than flyers. When we showed them on the playground those with the fewest wrinkles in the covering earned a "neat" response from the audience."

From "Wartime Modeling" by Bob Angel, Model Aviation December 2024

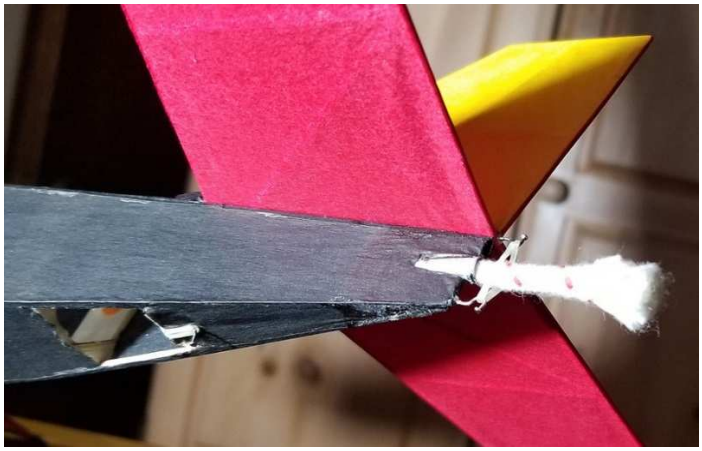


De-thermalizers
By Mike Jester

Unless you are new to outdoor free flight, you have probably had a model fly out of sight (OOS). If your model does not have a reliable de-thermalizer (DT) system on board, your chances of getting it back if it catches a thermal are greatly reduced. Even if your DT fails, or is inadequate in a boomer thermal, you may still get your model back if you are using an RF or GPS tracker system, which is a subject for another day. But what is a DT system? In short, it is typically a system that tips the stab and/or the wing upwards after a predetermined amount of time, to drastically reduce lift and increase drag, most often resulting in the model descending in a horizontal orientation. There are variations such as the pop-off wing DT and the split-stabilizer DT. Most DT systems require some sort of timing mechanism. This article reviews the various timing mechanisms that have been used successfully in DT systems over the years. I have extensive experience with all types of DT systems, except for the fuse DT.

Fuse DT

I recall reading that sometime in the late 1930's an avid modeler, who may have been Carl Goldberg, had the trailing edge (TE) of the horizontally stabilizer of his model come free and tilt up during a flight. The model descended quickly but gracefully. Eureka! Just time the release of the TE and you can get your model back. It did not take long before a length of fuse was mounted in a snuffer tube in the tail end of the fuselage. When it burns through enough of its exposed length, it severs a rubber band holding the TE down. The force of another rubber band pivots the stabilizer to an inclined position. The length of the fuse aft of the snuffer tube determines the trigger time. The fuse DT is simple and reliable and therefore it has probably been used for more than 80 years. However, it has a few problems. First, it cannot be used in states like California that are prone to wildfires. Second, the trigger time is very inaccurate. Third, the weight of the fuse diminishes as it burns, thereby slightly shifting the center of gravity (CG) forward which can adversely degrade the glide phase of the model. I have heard of models being lit on fire in the process of lighting the fuse.



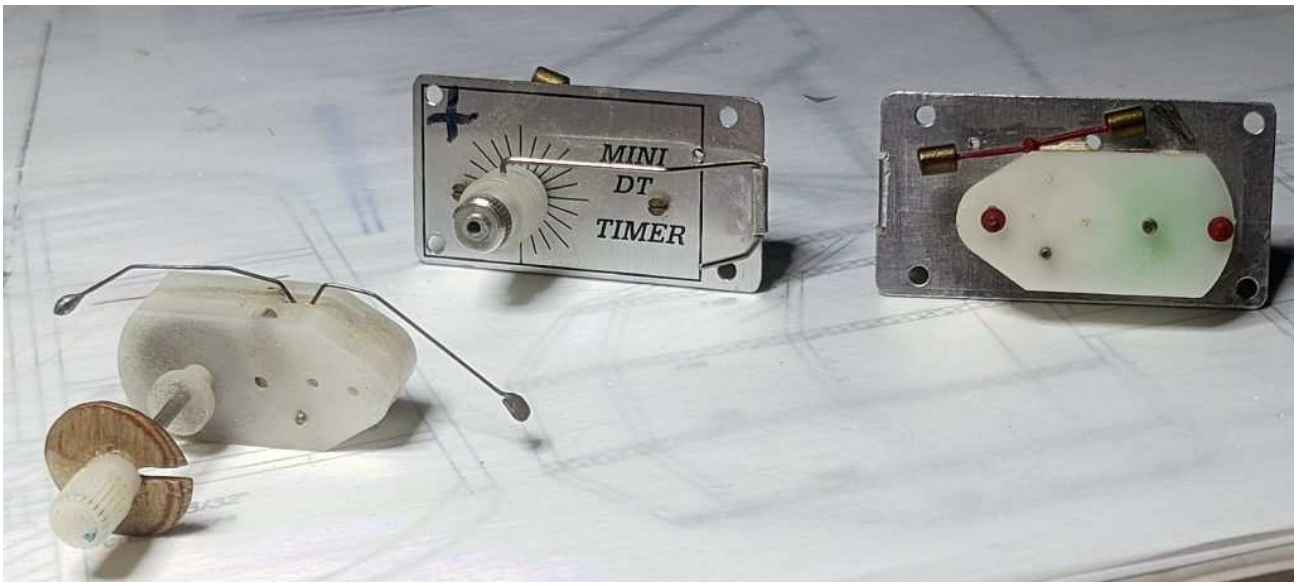
Fuse DT - Photo Attributed to George Bredehoft, Owner of Volare Products

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Mechanical/Clock Timer DT

In the distant past, some unknown flier got the idea of using a spring actuated timer in a DT system. He extracted the wind-up mechanism from a TOMY toy. These were small toys made in Japan by the tens of millions that could be wound up and they would race or hop across the floor. At one time I think McDonald's gave them away with its Happy Meal. They have a manually wound coil spring mechanism. It is necessary to add wiggler arms to slow down the rotation of the winding drum. Years ago, I purchased a TOMY timer re-purposed for a DT system and sold by Jim Springer, the proprietor of Zephyr Model Motors. It was extremely reliable and each full turn of the winding drum was one minute as I recall. It was a bit heavy at 4-5 grams. Jim seemed to shut down his business. I tried to duplicate his TOMY timer DT without success. Attaching the dithering arms was beyond my skill level. In my defense, George Bredehoft of Volare Products has had similar difficulties trying to re-engineer TOMY timers so they can work in a DT system. TOMY timers in DT systems were very popular in the US and the UK for many years, but are now obsolete due to advancements in micro-electronics and LiPo batteries.

A variation of the mechanical/clock timer DT is the Texas Timer, aka the "scroll timer." This device has a threaded cylinder and a pointer tracks along the same as it is rotated by a coil spring. At the end of the cylinder, the pointer goes free, and the spring biased arm holding the rubber band on the DT line is released. Scroll timers that are similar to the MINI DT TIMER have been widely used in gas models, but rarely used in rubber powered models due to their 5–6-gram weight.



Clock Timer DTs - Left to right - TOMY timer front, Texas timer front, TOMY timer rear - Photo Attributed to George Bredehoft, Owner of Volare Products

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Viscous Timer DT

An early viscous timer DT used a tub-in-tube mechanism that relied on the viscosity of Silly Putty to trigger the tilting of the stab and/or wing or some other change in the flight surfaces that brought the model down. It worked well but you had to make the viscous timer mechanism yourself. Someone then came up with the idea of using a rotary viscous damper. It is a small plastic device that uses the resistance of a disc or blades inside of a fluid filled housing coupled to a shaft that rotates a hub with lever arm externally of the housing. They are widely used to dampen the retraction of CD drive trays, for example. For many years a viscous damper called the Badge Classic timer was sold commercially for $20 that was apparently specially designed for our hobby and is well-suited for free flight models. It weighs a little over one gram. An even smaller version called the Button timer was also commercially available for use in hand launched gliders (HLGs). Check the Starlink-Flitetech website for availability. My attempts to use inexpensive commercial viscous dampers ($2-3 each) from electronic parts retailers have not been successful because I have yet to find one that has the appropriate rotary resistance. Stan Buddenbohm has mastered the art of building his own reliable rotary viscous timer DT into his world class CLGs which you can purchase (the ready-to-fly gliders, not the viscous timers).

The picture on the next page shows the implementation of a DT that incorporates a rotary viscous damper. A rubber band on the forward end of the DT line slips over the short arm of an inverted U-shaped pivoting pivotable “mouse trap” made of .025-inch or .031-inch music wire. One end of a coil spring made of .009-inch music wire is secured to a side of the fuselage and the other end to a string that extends over the long arm of the mouse trap. An intermediate segment of the mouse trap pivots inside of a segment of .062-inch Aluminum tube. The string attached to the forward end of the coil spring has a loop that slips over the lever arm of the viscous damper and stretches the spring. The lever arm is turned clock-wise to a predetermined position (e.g. “noon”) which determines how long it will take for the spring to slowly rotate the lever arm to a point (about five o’clock) where the loop is pulled off the lever arm. This allows the mouse trap to pivot, and release the DT line. Making the force that rotates the lever arm independent of the force that holds the stab down allows a strong force to be used for the latter, preventing “stab creep” and undesirable changes in the decalage prior to the DT triggering. If the DT line is directly connected to the lever arm, the force of the stretched spring or rubber band that rotates the lever arm must be weak to prevent it from rotating too quickly. You can avoid the complexity of the mouse trap by wrapping a non-stretchable length of DT line one turn around a capstan in the form of a short segment of 3/32-inch dowel mounted on the fuselage a few inches forward of the stab. However, in my experience, this implementation does not work nearly as well as the mouse trap implementation. The problem with a viscous timer DT is that the viscosity of the fluid varies with temperature, and therefore the DT often it triggers too soon or too late. Also, sometimes when the viscous timer DT is armed, and you are waiting to launch into good air, you can forget to reset the lever arm, resulting is a premature triggering of the DT and the loss of a potential max in a contest.



Viscous Rotary Damper DT with Mouse Trap Mounted on Three Nite P-30 Fuselage - By Mike Jester

Electronic DT

It was inevitable that tiny, lightweight electronic timer DTs would be developed and sold commercially. They are extremely accurate and reliable; however, they are much more expensive than the fuse, TOMY timer, and viscous timer DTs. In addition, you must also purchase a LiPo battery and a special low-power LiPo battery charger. In one version referred to as a band burner DT, a small Nichrome wire is heated red hot for 1-2 seconds after a pre-programmed amount of time has elapsed, e.g., 120 seconds. The heated wire severs a tightly stretched dental rubber band on the forward end of the DT line. One end of the dental rubber band is secured to a stud on the PC board and extends over the Nichrome wire. In another version, the electronic timer energizes a micro-servo so that its arm pivots and the DT line is released. Either implementation can include an onboard RF receiver so that the DT can be triggered by pushing a button on a hand-held RF transmitter. This implementation is referred to as radio de-thermalizer (RDT). It is very nice to be able to DT your model to achieve a short trim flight, save it from crashing, or prevent it from flying too far away and/or into trouble, like a row of trees.



Airtek RDT Receiver (blue), LiPo Battery (silver), and Micro-Servo (white)

Currently, the smallest electronic DT that is commercially available is the E-FUSE DT sold my Hummingbird Model Products. Including its LiPo battery, it only weighs 1.0 gram! Therefore, the E-FUSE DT is light enough to use on small stick and tissue models like Embryo and Dime Scale models without incurring a significant weight penalty. This electronic DT is even small enough for a Peanut model, but has anyone ever seen one of them fly OOS?

Whether to include a DT on your outdoor free flight model depends on the type of model, your risk tolerance, and your budget. Most scale models I have seen have not included a DT. They are hard to incorporate without negatively affecting the scale appearance of the model. Moreover, scale models seem to rarely fly OOS or be lost due to thermals. I still have my 30-inch wing span Fairchild 24 (pictured below) after it has achieved several maxes including a 6+ minute flight over ten years of flying, all with no DT. Most sport models like P-30, need a DT if you do not want to lose them OOS rather quickly. Simple fuse and viscous timer DTs are inexpensive and work well enough most of the time and do not result in a significant weight penalty. If you do not mind their cost, an electronic DT timer is really a good choice for large Old Time Rubber (OTR) models, Coupes, Wakefields, etc. They can easily carry their weight without any appreciable penalty on flight time. Of course, if you are a beginner, you first need to learn how to build and trim an outdoor free flight model so that is consistently flies longer than 45 seconds before you need to consider installing a DT. Or, you can just wait to install a DT after your first bittersweet moment when your model flies OOS in a thermal and is not recovered!



Fairchild 24 Without DT - By Mike Jester



SAN DIEGO ORBITEERS BOARD MEETING - Wed., December 11, 2024

Held at the Jester's home, with 10 in attendance, after a marvelous lunch, the meeting was called to order at 1:57 p.m.

The minutes of the previous meeting were approved as published.

Treasurer's Report wasn't received before the meeting, but looked good later.

Old Business:
Still looking into potential indoor flying sites, as the prospect we had in Oceanside fell through, unfortunately. Linda mentioned the possibility of using abandoned warehouses, and believes there are several in the Poway area.

Also still exploring outdoor flying sites within San Diego County, Mark doing some checking.

Don gave an update on the status of the AMA museum's P-30 exhibit that he is organizing.

Linda said we are "all set" with the annual awards banquet, a flyer should be out soon.

New Business:
Discussion of the Taibi field access, or lack thereof. An alternate route into the field is available.

Contest Corner:
Orbiteers helped time flights recently at SDSU for the AES 123 class led by Professor Gary Fogel. The class took place on December 4th on an outdoor field. It was fun helping the class.

Contest Reports:
The FAC contest in Buckeye, AZ was discussed as it was a John Hutchison Memorial contest held October 25-27. Unfortunately none of the board members present were able to attend, for a variety of reasons.

Don talked about the Dual Clubs Annual held in Lost Hills, CA Nov. 8-10, 2024. He reported that it was a great weekend, and fantastic contest with 34 flyers. The Juniors did really well.

Good of the Order:
The 1st quarter board meeting will be at the Chomyn's home, date to be announced later.

Meeting was adjourned at 3:20 p.m.

Respectfully submitted by John R. Merrill, amateur secretary.

San Diego Orbiteers

Flying Schedule 2025

Taibi Field Perris, Ca

Primary Date	Rain Date	Event	CD___
January 19	Postponed	~~P-30/Gliders/Power~~	
February 16	Feb 23	Coupe/Gliders/Power	
March 23	March 30	OT/NOS Rubber/Gliders/Power	
April 6	April 27	P-30/Gliders/Power	
May 18	May 25	Coupe/Gliders/Power	
June 22	June 29	OT/NOS Rubber/Glider/Power	
July 20	July 27	P-30/Gliders/Power	
August 17	Aug 24	Coupe/Gliders/Power	
September	(need dates)	Free Flight Champions, Lost Hills	
September 21	Sept 28	OT/NOS Rubber/Gliders/Power	
October 19	Oct 26	P30/Gliders/Power	
November 7,8,9		Dual Club, Lost Hills, Ca.	
November 23	Nov 30	Coupe/Gliders/Power	
December 21		Make-up	

MP 1/2025

FROM THE WORKBENCH - J.Merrill

I've been working on the Guillow's Hawker Typhoon for a little longer than I expected, but it's coming along. It's about ready to get covered. I tend to forget that the relatively simple Walnut Scale kits, intended mostly for beginners, take a bit of "kit bashing".

Also still working on the P-30 'Echo'. I received the short-kit as a gift, and it's getting close as well. Just a bit more covering to go. I'm using Eze-Tissue on this one.

Finally, just the wing and tail are covered so far on the Fairchild trainer, one of the Double Nickel series from P.T. Aviation put out by William Scott.
I just need to finish the nose block and fuselage covering.

I've been working on a from a 24" Easy Built kit. All done except tail struts, canopy, gun details, and nose block. It's in a Spanish Civil War scheme. I'm hoping it'll fly well enough for the next Scale Staffel contest.

That's it for this month. Hopefully by next month I'll have these finished up, and be on to my next projects. So, what's on your workbench?



Guillow's Hawker Typhoon



P-30 'Echo'



Bf-109



← Fairchild trainer

TECH TAKE

By **Graham Warwick**

For the latest, go to **AVIATIONWEEK.COM**

Covert Feathers Inspire New Flap Design

Engineers at Princeton University have tested wing flaps that mimic the covert feathers that birds deploy when maneuvering or landing. Tests on a bird-scale remote-control model aircraft indicate the flaps improve flight performance and help prevent stalling.



PRINCETON ENGINEERING

Inspired by birds, Princeton's stall-initiated, passively deployed flaps expand the aircraft's flight envelope.

"These flaps can both help the airplane avoid stall and make it easier to regain control when stall does occur," says Aimy Wissa, assistant professor at Princeton's School of Engineering and Applied Science and principal investigator for the study published in the "Proceedings of the National Academy of Sciences."

"Multiple rows of covert feathers contour bird wings, and studies suggest they can enhance flight during maneuvers such as landing or flying through gusts," the paper states. A bird's covert feathers cover other feathers and help smooth airflow over the wings and tail.

Initiated by the stall, the simple flaps developed by Princeton deploy passively in response to changes in airflow, requiring no external control mechanism. "They offer an inexpensive and lightweight method to increase flight performance without complex machinery," the researchers write.

In a series of experiments in Princeton's wind tunnel, the research identified two distinct location-sensitive aerodynamic mechanisms and determined that a covert-inspired flap system exploiting both mechanisms improves aerodynamic efficiency and stability.

A new mechanism, called shear layer interaction, was uncovered while testing the effect of a single flap near the leading edge of the wing. The other mechanism was found to be effective only when the flap is at the trailing edge of the wing.

"The discovery of this new mechanism unlocked a secret behind why birds have these feathers near the front of the wings and how we can use these flaps for aircraft," Wissa says. "Especially because we found that the more flaps you add to the front of the wing, the higher the performance benefit."

Canada Funds Sustainable Propulsion Research

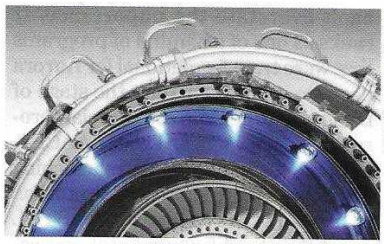
Turbine engine materials, hydrogen fuel cells, electric aircraft and hydrogen combustion engines are among the first round of research projects announced under a Canadian government initiative to support the decarbonization of aviation.

Total investment in the five projects is C$101 million ($72.5 million), which includes C$28 million from the government's Strategic Innovation Fund through the Initiative for Sustainable Aviation Technology (INSAT). Launched in June 2023, INSAT will provide a total of C$350 million in federal funding support over multiple rounds.

Under the first round, Pratt & Whitney Canada (P&WC) aims to demonstrate hydrogen combustion in a PW-127XT regional turboprop engine. The PW127XT powers the ATR 42/72-600 and Deutsche Aircraft D328eco. The Hydrogen Advanced Design Engine Study (HyADES) includes Next Hydrogen Solutions, which intends to develop high-efficiency, low-cost electrolyzers to establish a green hydrogen production infrastructure.

Funding for the first phase of the project will include fuel nozzle and combustor rig testing using hydrogen fuel, while future phases will target full engine ground testing. Tests under the first phase will use gaseous hydrogen, P&WC says. Future phases aim to demonstrate potential system-level benefits through the use of liquid hydrogen.

Under the Turbine Engine Advanced Materials for Efficiency (TEAME) project, P&WC also will collaborate with Ottawa-based Derivation Research Laboratory to explore advanced materials for hot-section components to improve thermal efficiency and reduce fuel consumption and emissions.



PRATT & WHITNEY CANADA

Pratt & Whitney Canada will rig-test hydrogen combustion under the Canadian-backed HyADES project.

Under INSAT, startup Duxion Motors' 250-kW eJet electric ducted fan will complete ground testing and be prepared for flight testing on a single-engine, single-seat experimental jet powered by batteries. Based in Newfoundland and Labrador, Duxion will collaborate with Tronosjet Maintenance on Prince Edward Island.

Another project will support British Columbia-based Harbour Air's program to electrify the de Havilland Canada DHC-2 Beaver. The seaplane operator plans to equip its entire fleet with MagniX magni650 electric propulsion and H55 battery systems, sell conversions to other operators and modify other aircraft types. Partnered with Harbour Air, Elevate Aviation plans to establish a learning center in Vancouver to develop a pipeline of professionals to design, operate and maintain electric aircraft.

Also in British Columbia, Ballard Power Systems and Hydrogen In Motion will combine a high-power-density fuel-cell stack and solid-state hydrogen storage system in an effort to develop a scalable, cost-efficient hydrogen-electric power system that addresses weight and volume and improves refueling logistics.

ETH Zurich Tackles Hydrogen Combustion Vibrations

In a jet engine, the turbulent combustion of fuel generates sound waves that reflect off of the walls of the combustion

can't overstate the importance. It ranks as one of a handful of programs that were transformational for Aurora because it put them onto the stage of being able to get into commercial aerospace. When we heard about AACES, it sounded a lot like NASA relaunching one of their more successful ventures."

Instead of the EL9's extreme STOL capability, the lift augmentation provided by distributed electric propulsion in Electra's AACES concept enables a smaller wing sized for cruise efficiency. In the point-of-departure concept, the wing is combined with a D8-like wide double-bubble lifting fuselage and boundary-layer-ingestion propulsion using electric-driven ducted fans embedded in the aft fuselage.

Electra's team includes American Airlines, Honeywell Aerospace Technologies, Lockheed Martin Skunk Works, MIT and the University of Michigan. The team will be led by Alejandra Uranga, Electra's chief engineer for research and future concepts, who previously co-led an N+3 program as a research engineer at MIT.

"What we love about AACES is it's a chance to think big," Langford says. "Our mantra at Electra is 'think big, start small and act now.' The EL2 technology demonstrator that's flying is the 'act now.' The 'start small' is the EL9 nine-seat certified hybrid-electric Ultra Short. And the 'think big' is AACES, because it is shaping what commercial aviation is going to look like in 2050."

The challenge "is balancing those 'think big, start small, act now' things while keeping a relentless focus on the immediate things that will establish us as a serial producer of certified airplanes, something that Aurora never did," Langford says. He notes that AACES allows Electra "to bring to bear a lot of the ideas that were too far out to put in our first generation of products because we're a startup, and you can't do everything at once."

Instead of the metrics used in N+3, AACES provides suggested scenarios for commercial aviation in 2050 but allows performers to evolve their own scenarios. "The importance of having American Airlines on our team is because NASA can make up scenarios, but the people who are out there flying the routes today, their input is absolutely critical to thinking about, what kind of airplanes are they going to want to be buying in 2040 or 2050," Langford says. Lockheed's Skunk Works will perform a similar role for the military market.



JetZero will evaluate technologies that enable using cryogenic liquid hydrogen to reduce greenhouse gas emissions.

Pratt & Whitney, meanwhile, is exploring various future hydrogen fuel options including nearer-term studies of dual-fuel systems combining gaseous hydrogen and liquid kerosene. The concept would incorporate two fuel systems feeding into the same combustor and would be switchable in flight between the two fuels. The dual-fuel system would enable an aircraft to cruise on hydrogen and use kerosene in wing tanks for reserves.

Pratt has research underway to optimize a hydrogen-enabled combustor for reduced NOx emissions, and further off is studying liquid hydrogen (LH_2) for very low overall emissions. Funded by the U.S. Energy Department's Advanced Research Projects Agency – Energy, Pratt's Hydrogen Steam-Injected, Inter-Cooled Turbine Engine (HySIITE) project is focused on technology building blocks such as a low-NOx combustor, an evaporator made using advanced manufacturing processes and an LH_2-assisted condenser.

JetZero's AACES work represents one of NASA's first contract awards directly involving the potential use of LH_2 for civil aviation, covering studies of both conventional tube-and-wing and BWB configurations. Romar Frazier, head of propulsion for JetZero, says the company is "honored NASA has selected our team to conduct the important work of bringing together the potential for a liquid hydrogen powered, long-range BWB."

The AACES win comes just two months after European low-cost carrier EasyJet teamed with JetZero to study the opportunity to use the BWB as a platform for hydrogen-powered engine technology. Under the partnership, EasyJet says it will share knowledge gained from earlier cryogenic fuel studies conducted with Airbus and Rolls-Royce under the UK Hydrogen in Aviation Alliance project.

JetZero says the BWB configuration provides greater internal volume for larger hydrogen fuel tanks than tube-and-wing aircraft. As part of concept studies, the company already has outlined provisions for potential hydrogen tank locations outboard of the BWB's main cabin where the deep wing root fairings meet the body.

Like N+3 before it, AACES is expected to have a lasting impact on the industry in terms of people as much as technologies. "N+3 became a talent pipeline at the universities," says John Tylko, former Aurora chief innovation officer. "Now we're leveraging the passion of the entire community, because at a place like MIT, a large percentage of freshmen and graduate students are passionate about sustainability, and NASA is shaping that pipeline."

Check 6 *Rich Wahls, NASA's Sustainable Flight National Partnership mission integration manager, discusses the importance of the new contracts with Guy Norris and Graham Warwick:* **AviationWeek.com/Check6**

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EL TORBELLINO



WHAT'S HAPPENING - OCTOBER 2024

January Postponed	-	See enclosed schedule for 2026
February 16	-	San Diego Orbiteer Outdoor Monthly Events: Coupe / Glider / Power Taibi Flying Field, Perris CA, 7:30 am