THE GRAPEVINE

There is a very fine line between "hobby" and "mental illness."

Vol. XXX, EAA Chapter 663 LIVERMORE, CA No. 6, June 2011

Officers

President Ralph Cloud	449-1048
Vice President Dave Dent	447-8055
Trea$Urer Mark Palajac	510-557-4020
Secretary Kirk Knight	510-390-0840
Program Co-Ord Don Smith	785-5824
Tech Counselor Dave Dent	447-8055
Tech Counselor Gordon Jones	447-1549
Tech Counselor Bob Sinclair	935-7465
News Letter Emeritus John Meyer	
News Letter Editor Jeffry Larson	209-608-5981
Flight Advisor Barry Weber	963-0824
Flight Advisor Bob Farnam	449-1513
Young Eagles Trina Anderson	209-832-1162
Librarian Alan Thayer	582-7274
Web Editor Brad Olson	866-9289

Board Of Directors

Bruce Cruikshank	510-886-6897
John Goldsmith	925-447-7362
Brad Oliver	925-443-1135
Bob Farnam	449-1513
Dick Jennings	862-2345
Bob Cowan	373 0555

June Meeting And Program

NOTICE: Our June meeting will take place at 7:30 P.M. on the 2nd of June. The meeting will be at the terminal - KLVK.

Calendar:

Month	Date	Speaker	Topic
~~Apr~~	~~7~~	~~Paul Milner~~	~~AvGas & MoGas~~
~~May~~	~~5~~	~~Craig Catto~~	~~Props~~
June	2	Guy Minor - FAA	Aviation Accidents

Our June Program will feature the speaker Guy Minor from the FAA. He will be speaking on the subject of "Lessons learned from Sport Aviation Accidents."

Guy is the FAA Safety Team Program Manager and a great speaker on many subjects related to aviation safety. I'm sure we will all gain something from his talk.

Mailbag:

DUES:

Mark Palajac will be accepting checks for renewing membership. Checks should be made out to EAA 663. You can give them to Mark at the meeting or mail them to his home at:
25 Jacaranda Drive, Fremont CA 94539.

Chapter Airplane Survey:

I will continue to gather data, so if you have not responded to the survey, take a few minutes and send it in and the totals will be updated in a future newsletter. – Jeffry

Website update from Brad:
I deleted aircraft photos/slide shows for Alair, Bodie, DeFord, Fish, McAllister and Vetterli. The member's page was updated to add Irion, Mitchell, Prost, Rowe, Smith(Doug), Stewart, Supan, Turner, Wraa, and Wynn. Deleted (along with passwords where applicable) were Alair, Bennitt, Bode, Cawbdy, Bulena, DeFord Fish, Flagg, Gaglia, Grey, Hyde, James, Kamal, Keller, Kirker, Lindstrom, Lugton, McAllister, Mills, Persson, Peterson (Paul), Rooks, Schlichter, Slater, Smith (Don), and Vetterli.

Brad

May 2011 Minutes
GENERAL MEETING, EAA 663,
5/57/2011 Livermore Terminal
Called to order 7:38 PM by President Ralph Cloud.

Other Board Members in attendance were Dave Dent, Vice President, Mark Palajac, Treasurer and Kirk Knight, Secretary.

GUESTS: Sam Kittle, a Q-200 owner, was visiting from Angels Camp. He reminded 663 members about a Q-200 fly-in the last weekend of August. Tim Uphouse from Oakdale EAA 90 wants to know more about propellers. Other guests included Dave Stiehr from Attitude Aviation and Casey Hunter from Concord.

MINUTES: Errata in April minutes: Ronald LaPell is really Rolland LaPelle, EAA 62 past President and now welcome at 663. Frank Mitchell of Hayward was but a mere teen when the first and second experimental homebuilt aircraft were built in Canada – he wasn't responsible for their construction, but did see history being made. Chuck Ray and Dave Ray (not Ray and Chuck) finished their starboard wing and will be starting on the port wing. BBQ dates were incorrect – see below. Minutes, with corrections, were moved and accepted. It's reassuring to know that members care enough to read our minutes.

TREASURER'S REPORT: Mark announced the balance prior to start of the meeting was $4,850.31. We have recently paid $131 for web hosting, and a donation to UC Davis Medical Center for $150. Mark has had 24 responses from the survey concerning the annual dinner and invites more responses. Report moved and accepted.

YOUNG EAGLES: Trina bestowed patches and pens to those who flew 10 or more Young Eagles in 2010. Special thanks to Leland Collins, Bruce Cruikshank, Bob Cowan, Brad Olson, and Jeffry Larson. Next Young Eagle event May 28 at TCY. Tracy will be having an airport day with Skyview Aviation. A $10 raffle for SPOT location with first year's subscription: value $300. June event will be at LVK.

TOOLS: The bead blaster now has new medium grit glass in supply and has seen use.

WEBSITE: Brad has featured Harry Crosby at Oshkosh with his Catto prop. If you're a member but don't have access email Brad Olson for username and password to web@eaa663.org. To send pictures to pictures@eaa663.org

NEWSLETTER – Jeffry Larson announced this month's mystery plane winner is Leland Collins. Jeffry updated the survey results about who is building what. We have 26-28 projects under construction with a wide variety of designs. Bob Buckthal is reassured that this debunks rumors we're only building RVs.

ANNOUNCEMENTS: May 19th Board Meeting at Ralph's house in Livermore. June 2 Chapter meeting.

CHAPTER ANNOUNCEMENTS: Chapter BBQs will be May 14, June 18, July 9, August 20, and September 17. Show up at 5 pm to Bob Buchthal's hangar with coals; bring entre for self and side dish to share.

PLACES TO GO: Minter Field will have annual fly-in event on May 14 themed "Salute to Veterans." Before Memorial Day in late May Beale will have an open house. Chino will have Planes of Fame event on May 14. Sonex fly-in in Rio Linda May 14. Willits fly-in May 15th. Rancho Murietta fly in May 21st. Carson City June 18th.

MEMBERS FORUM:

FAA line examiners are very active, looking more closely at experimentals. They report higher percentage of problems with experimentals than GA.

Dave Dent is following up on the observation platform repairs.

Dave Anderson provided an update on real estate development plans near Tracy and Stockton airports with hearing before the county Airport Land Use Commission. The Cal Pilots Association is making a difference by being visible, professional and prepared to rebut developer claims. All plans for construction near Tracy runway 23 and Stockton runway 26 are effectively stopped. The judge threw out the previous plans and is now requiring the developer to start over.

SAFETY TALK: Dave Dent – Sticking Valves

In the past 2 weeks he's been approached by two people concerned about valve sticking. It's a critical issue that will be brought up more frequently because of the price of gas. The price of gas affects valves?

Pilots want to save a buck so they throttle back their engine, lower RPM and end up with bad cooling. Bad cooling leads to bad (lead) scavenging and valve sticking.

Don't try to save a buck on gas, because it will cost you more in airplane repairs.
Dave asked the indelicate question about how many members in attendance were over 55 (nearly every hand went up) and already flying your airplane (not quite as many, but a lot). Chances are you will not live long enough to fly the hours off your engine. So the next owner of your airplane is going to pay for fixing that valve – if you don't damage it yourself first and learn about it the hard way.

Don't try to save the penny. These engines are meant to be driven at high RPM, not dragged through the air.

Back in 1988 when we still had 80 octane gas a service bulletin was issued concerning valves sticking. [from last month's guest speaker on avgas you may recall that 80 octane often left the refinery as low lead due to easy to meet octane requirements.] Then we went to 100LL. An additive called AVBLEND was advised in an AD note for Lycoming engines. Most experimental owners were too cheap to put this $25 additive in every now and then, but it was for scavenging to protect your engine, especially if it sits around without use. Today AVBLEND component is incorporated in 100 Plus oil and multigrade oils to provide continuous protection.

But now that we're dragging through the air at low RPMs you're endangering your engine with lower heat and insufficient stochiomentric efficiency [yes Dave said that] to promote scavenging. If you're not going to fly 100 hours a year, and few us do these days, but you're flying 50 and delaying oil changes, he recommends changing at 25 hours. He also recommends always changing the oil filter and the intake filter, and checking the oil scavage screen.

As a note, if you frequently fly from asphalt runways the silica from the asphalt can damage your rings if you don't change your air intake filter frequently.

Many people don't know about oil scavenge screen. He does annuals on plane where the owner doesn't even know he has a scavenge screen and has never had it checked.

Dave doesn't want to see planes that sit a long time between use being run up on the ramp to get the temp up with the intent to cook the engine to get the moisture out. That's bad procedure and causes more acid in the oil. It would be better to go out more frequently and just spin the engine with the starter to get the oil moving through it. That will lubricate surfaces and keep acidics low.

Some of what we learned pre-1988 doesn't apply today. We had low compression engines, 80 octane fuel, and solid 7/16" valves. Newer engines have valves that are sodium filled, ½" size, and new valve guides, so they handle heat transfer differently than the old style. Check with your ADs and A&P for advice on proper use.

In these times of high fuel costs we need to be smarter. Don't lug your engines. Keep 'em cool. Keep 'em running at high revs where they're designed to operate for longer life and reliability. And stay safe out there.

Break at for cookies. Back at 8:17

THIS MONTH'S GUEST:

Craig Catto of Catto Propellers was invited by Dave Dent to provide details on propeller design, performance and maintenance. Craig has built over 5,000 propellers and he generously shared his knowledge on the subject. Thank you Craig for a most enlightening presentation.

See long report on Craig's presentation in the June Grapevine.

MEETING ADJOURNED 10:04 PM

Minutes respectfully submitted by Kirk Knight, Chapter Secretary

Minutes
BOARD MEETING, EAA 663,
The Board of Directors attended a FAA Safety seminar at 7:00 pm on May 19th, then met briefly over pie to address pressing issues of the chapter. There was no quorum and no minutes were recorded.

Ralph

Feedback/Questions/Suggestions

Any and all feedback is welcome. Please take a few minutes to send suggestions, tips, corrections or any other feedback to: jeffrylite@comcast.net.

Mailbag: - Transcription from our guest speaker last month as per Kirk.

Craig Catto of Catto Propellers:
All about Prop's?
May 5, 2011
EAA 663 Livermore California

Craig has been building propellers for 36 years.

Craig showed off the 80 inch diameter Pathfinder propeller and related how he got the contract to produce it.
Dave Dent of EAA 663 introduced Craig to senior engineers at Aerovironment. Craig joked that for his first meeting he walked into a room full of people with PhDs in engineering and he graduated high school – early - so he tried to use as many big words as possible.

He left the meeting with a check in hand to build a propeller. As he left the room he asked, "How heavy can it be?" They had previously built balsa propellers that were constantly destroyed. A conversation among the engineers started with 4 pounds, and then 3 pounds, and gradually the spec became lighter and lighter.

Finally, some said, "If you hold the propeller 4 feet above the ground and let go of it, if it hits the ground it's too heavy."

Each Pathfinder blade weights 9 ounces – yes, ounces – and is made of Kevlar and fiberglass, and the complete prop is less than 2 pounds. They didn't want to risk a large radar signature from 8 propellers so they didn't use carbon fiber. So it's hollow, with a balsa core shear web. But there's no closed cell structural components due to the high altitude requirement (over 65,000 feet) that would result in expansion of air trapped in the cells. Each blade is hollow, but it vents through the hub. The hubs were built at Lawrence Livermore Labs.

They did load testing on the propeller, spin testing and it passed. An altitude chamber was used to test up to 75,000 feet at 1,200 RPM, with special concern for static electricity charges.

Dave Dent noted that the Pathfinder was designed to fly at 35,000 feet with 650 RPM per prop. It worked so well they then flew it up to 75,000 feet. They noticed strong vibration on the video and traced it to unbalanced props. Dave put the props on a model airplane balancer and noticed the blades weren't tracking. He developed an algorithm to calculate the amount of mass to balance the blades and then used spray paint – yes, just a slight mist of paint – to balance the props. They then flew to 83,000 feet with the props at about 1,700 RPM!

Pathfinder now hangs in the Smithsonian in Washington, D.C.

Craig's wife isn't an airplane person, she thinks he just has a small business and works from home in the hills in California's historic gold country. She wonders why people would want to hear him talk about propellers and ask him questions. "Here's a question you can answer: If you're so famous, where's all the money?"

He's headed to Brazil to meet with professor Paulo Iscold at Federal University of Minas Gerais-Brazil who set 4 world records (see Sport Aviation). It's using 20 year old Catto props and Craig will help with optimizing for next records.

He started makings props in 1975. One of the first was the infancy of ultralights he built with his brother using an Icarus 2 biplane hang glider powered with a stock Mac 101 2-stroke go-kart engine – "Run like hell and hope you don't trip." No, he didn't know why his parents let them do this. At some point they put the Icarus on wheels and that was beginning of ultralight aviation.

He brought the powered Icarus to San Jose FSDO to get it certified as an experimental. The FSDO inspector said it didn't have an oil pressure gauge (it was a 2-stroke engine), so he wouldn't give it an airworthiness certificate. So Craig went to an auto parts store, bought a gauge, painted a green arc from 0 to the max, stuck it on the plane with some wires running back to the engine and received his airworthiness certificate.

He made that first small prop that spun at 8,000 RPM direct drive from the 2-stroke engine.

5,000 props later….

He designed the Solo and also the Goldwing for another company, one of which an EAA 663 Chapter member built. At Watsonville he saw Burt Rutan fly in with the VariEze and that started him playing with fiberglass.

He built perhaps a thousand props for Australian ultralights – all by hand.

He had a Formula 1 pilot ask for a carbon fiber wing. Craig agreed to do it so long as he could build one and test it to destruction prior to ever flying one. The spar weighs 22 pounds. The 22 foot wing without ailerons is about 70 pounds. They tested it with 10,000 pounds of mass, it deflected about 7 inches, but never broke.

He went on to work with Mike Arnold who designed Endeavor and Craig built the wing and the tail. At the races, out of 8 aircraft in the gold, 7 had his wing and tail.

"Can you built a rocket nose cone and fins," asked Dave Dent. "Sure," said Craig, envisioning very limited product liability for something that goes up, lands in the oceans, sinks, and you're done. This was for a hydrazine pulse rocket motor designed to go 3 kilometers per second, with launch from Vandenberg.

He showed Burt Rutan's Raptor demonstrator - version 2, now in a museum at Edwards. Craig made a big 3 blade, ground adjustable propeller of molded fiberglas. The first had some issues with a pair of autopilots, per DoE buyer, that got into a disagreement and literally flew the wings off. However, the telemetry reported the prop held together up to 9,000 RPM before it made a deep crater.

Back in the day security at Dryden was a bit different. He was working at the request of Dave Dent. Craig shows up and needs to get on the base, so he calls Dave. Dave drives over to the inside of the fence, hands his security badge through the fence, then passes his briefcase over the fence. Craig drives down the road a bit to the entrance gate, shows "his" badge, and is allowed to walk into the base, whereupon he returns Dave's badge. Note that Dave has been bald for quite a while, and Craig has all his hair.

Utah University built a Wright Model 3 and Craig built the custom props. It used a Harley engine and has made over 400 flights. It's now a traveling museum for the university.

Dave heard about Craig's props and Craig built a prop for Dave's Long EZ. One thing led to another and he built hundreds of pusher props, mostly 3 blades. Then the RVs came along. One of the things about a 3 blade pusher prop is that eventually something is going to go through the propeller arc – it's not if, it's when. The composite props are very durable.

Craig had some photos. Ray McCrea recounted he had 6 inches of his Long EZ exhaust depart his aircraft, go through the prop arc, make a big bang. He shut down the engine, landed dead stick and looked at the results. It turned out there were shallow dents on two blade leading edges. A bit of flox, some sanding and paint returned it all to flying condition.

Craig has heard of cowlings coming off on several aircraft with no problem for the props. A Bearkut near LA on a short field with a big wall at the end of the runway had the back canopy come off during takeoff and go through the prop. It took off a couple inches from the tips of two blades. But the pilot firewalled the engine, cleared the wall, reached pattern altitude necessary to fly a 180 and land downwind. The prop held together.

Craig says thank you RV's! It's an amazing market. Metal propellers have horrible harmonics. Craig's props aren't sold through the RV catalog. "What's the difference in weight," asked a chapter member. The Sensenich is about 35 pounds and the Catto is about 16 pounds.

Craig noted that he can do things with composites that are difficult to do with metal. "We have complete freedom aerodynamically, fine tuning blade area and twist, without worrying about harmonics."

A meta propeller is a tuning fork. His props start with laminated sawn cut thick wood, not thin laminates. The hub is this thick laminate. Then he uses both fiberglass and carbon fiber as structural members. Out near the tip it's a thin as a metal prop, but the wood is thin covered with about 0.080" thick composite over the entire prop. From the tip in, the wood core continues into the hub, with the thick wood providing natural dampening characteristics for the engine pulses. "It's a wonderful combination of materials," notes Craig.

It's unlike the MT which is a wood propeller with a fiberglass covering to keep the weather out, not as a key structural member. Hoffman is similar. It's composite with 2 different materials, but not as structural members.

He built a 76" prop for an RV-10. A neighbor had an identical plane with an MT constant speed prop. Performance was identical (note the prices were quite different with the MT selling for $15,000 vs about $3,200 for the Catto). Low speed performance was excellent. Climb rate was identical. Fuel flows vs. airspeed, identical.

CubCrafters approached him in 2009 for 180 HP LSA. A metal prop put it overweight – 38 pounds vs his 13 pounds. It will do 145 knots all out. He then focused on reproducibility for the LSA market.

He converted to CNC manufacturing for all processes within about 5 minutes a degree on blade angles. He built a 2,500 sq foot facility next to his home with a massive CNC machine he's dubbed "The Beast." It weighs 10,000 pounds and is 22 feet long. He put it on the concrete pad, bolted it in place, and constructed the building around it. The field is 5x10 feet, and boast a 14 horsepower router and 8 tool changer head. The servos will exert 2,000 pounds of load.

If something starts going wrong you need to hit the stop button instantly. He makes a lot of firewood from the trims.

One of the smaller props he builds is a 78 inch 2 blade prop for CubCrafters. Craig has been pursuing Alaska pilots and at last year's Valdez flying event 4 of top 5 had his prop including first place. Tip speeds are high, they're used by bush pilots who have to fly in rain and unimproved sites such as river beds. The leading edges were taking a getting torn up something serious so they tried prop tape. That was fine at reduced power settings but not a high power settings.

One of the CarbonCubs was put on floats and the prop came back within weeks with the leading edge torn up. The owner had to replace the leading edge tape, Prop Guard tape, every week. It also reduces performance by up to 3 knots. Craig developed a nickel leading edge and that's made a huge improvement in durability with no loss of performance. They're up to 420 hours on the prop for the float CarbonCubs.

The leading edge is done by a company back east with electroplating process that does work for F-22s. It's built up on a mandrel and has a Rockwell hardness rating of 84. By comparison MT stamped stainless is about 25-30 Rockwell. Thickness is 0.030 inch at leading edge and then tapers back to 0.007 inch.

He vacuum-forms the nickel edge to the prop and adds two screws just in case. Hartzell runs theirs nearly into the hub to increase the adhesion area – and their tooling is much more expensive. They don't use screws, but bond only.

Craig has 2 styles of leading edges. One for the Cubs another for RVs. The Cub's is longer, but the leading edge contour is the same on all models. Cost is $145 a blade and they can be retrofitted.

Paul Bennet o Maxx-G Aerobatics is aerobatic champ in Australia – their Shawn Tucker. He has a 3 bladed Catto prop. Thanks to Paul's success Craig ships an aerobatic prop to Australia every month for other pilots who want the same performance. The lighter weight makes a big improvement in handling by reducing gyroscopic forces. If you want to know about prop durability look at the YouTube video of Paul. http://maxxgaerobatics.com.au/

The biggest CNC problem was duplicating what he'd done in the past with manual methods. He custom built a table for laser scanning a blade. Resolution in 0.005-6 inch. He uses Rhinoceros modeling and RhinoCAM for his CNC. He joked that when he shifted to CNC he turned off his DISH network subscription – for about 5 months – to force himself to read all the manuals.

He uses epoxy – DevCon epoxy material to get reproducible performance rather than mixing each batch.

It takes about an hour process to cut the wood prop to 0.080" resolution. He'll then hand sand it to smooth out the scalloping. The wood is all laminated maple held with Weldwood.

2 blade or 3 blade? (We'll quote Craig to be sure we don't miss anything important.)

"All the hangar talk is just that. There's a lot of factors. Start with the engine and the mission.

"We could build this CarbonCub prop as a 90" and the chord would come way down, it would extremely narrow. Ideally you want to move the largest volume of air with the least change in velocity possible – velocity in is close to velocity out. It's the same principal as high bypass jet engine. Diameter matters as long as you don't get up to Mach numbers. If we stretch this Cub blade out to 90" we're still below Mach 1 at the normal engine RPM, but the blade chord is about 2" wide and ¾" thick. But now you're playing with Reynolds number issues and structural issues. There are those types of things that weigh on optimization.

"You bring the diameter down. What I like is an aspect ratio of 2.5:1 to 3:1, the taper ratio. If we restrict blade diameter the blade area is squared, so we end up with this huge paddle – low aspect ratio. So then it becomes beneficial to add another blade – a third blade in this case. That gets the aspect ratio and taper ratio back to optimum.

"Why not a single blade with a counterweight - well, it's not optimum. For each application depending upon diameter, speed range; the faster the airplane, the blade area comes down, the pitch goes up. The slower the aircraft, the blade area goes up, the pitch comes down.

"I make that 90" for Alaska bush pilots doing what they call stump pulling. 180 HP, 90" prop is about 7" wide at maximum chord. Static pull is about 900 pounds. Compare to 180 HP RV that you can probably hold on the ground by yourself with max 200 pound static pull.

"But for the 'crazies' in Alaska 900 pounds is not enough, so they add nitrous bottles. They hit nitrous, add 50-70 HP and get over 1,000 pounds of pull on an 1,100 pound plane. The blades will cone. We went from 84" to 90" using same carbon laminates and same bending nodes we were getting high speed tip flutter. But the static pull decreased from 900 to 650. Sure enough we videotaped the tips and the blur showed that we were getting flutter from the high frequency shock waves. Everything goes to hell.

"We put our double carbon aerobatic layups on the blades and got the stiffness out of the prop to get the flutter out."

[Back to summarizing Craig]

Comment from Ray McCrea that the 3 blade reduces the pulses on his Long EZ to smooth out the vibrations. Craig notes that a 2 blade prop, with 4 cylinder engine, with 2 trailing edges from wing is going to have lots of harmonics, but less with 3 blade prop. Blades are in different position with firing pulses.

He's built nearly all of the Paul Lipps props. Craig brought up an RV prop and added 6 knots at Reno. Tom Eberle's Phantom is very fast. Lipps designs have great race performance, but penalties that are not beneficial for general flying.

Why is Craig's prop design is different from others, for example, Sensenich? He sketched a big U and called it the drag curve or drag bucket.

"The bottom of the bucket is the middle and you can design off either end of the drag curve. The difference is you get a higher lift coefficient or lower lift coefficient off the drag bucket will change the amount of blade area you have," he drew with his hands.

Craig went into detail holding his prop, "People will look at the metal Sensenich and note it's 70" in diameter and the chord is like that. My prop is 68" in diameter and the chord is about the same, maybe a bit bigger. How can you swing all that blade area? I do it by operating at the other end - the back edge - the lower lift coefficient - of the drag bucket.

"My prop will hook up faster on the take-off roll. It's lower pitch angle but higher blade area. Sensich is higher blade angle but lower blade area. So it takes them longer to hook up and become unstalled. We have a higher spectrum of efficiency.

"It changes pattern characteristics. With my 3 bladed prop you'll pull back power and it is more like a constant speed and will glide and coast, but reach a point where it will bite and start to deccelerate unlike a 2 blade Sensenich fixed pitch. They act differently because of blade angle of attack and blade area," summarized Craig

How do I choose a prop? What looks cooler?

A 3 blade will outclimb a 2 blade by about 8-10%. Top end is within 1 knot if they're designed properly such as 70x70 2 blade vs 68x70 3 blade.

What do you optimize for? Climb or cruise?

Craig starts by asking, "What RPM range do you want to see your engine?" Percentage of power at altitude is a function of heat the engine puts out. How do you set up your EFIS, fuel flows, flight plans, etc. He'll allow for some overspeed on the top end but typically few pilots operate WOT. Well, Ray admits that his Long EZ is 11,500' WOT, flat out as fast a he can go to get there. This gives good static RPM for takeoff.

Craig notes that if you have an older prop his new props are much better. This may have been a sales pitch. But Craig notes that his CNC makes it easy to make improvements over past hand built designs. Root area, high angles of attack. Center of prop the normal range. The transonic range out to supersonic sections and Mach 1 at the tip. 3 blended sections of airfoil to enable performance with minimal drag penalty as tip nears Mach 1. The Reno racing really advances the technology.

What about electric airplane props? No different principles.

How does he know he's getting drag at high speed? The 90" on SuperCubs at 2350 isn't a problem, but up an 2750 RPM and 110 knots you're sucking fuel and making noise. Drop the engine back to 2450 RPM and you lose 5 knots. It takes horsepower to create noise.

You may discover for your own homebuilt that your old wooden prop has a drag penalty. If you plot airspeed for each 100 RPM you'll see it. The old Clark Y airfoil at 3 degrees angle of attack creates a Mach shockwave at Mach 0.55 on the top of the airfoil.

Will my new Catto prop get me a few knots faster? Look at HP. Can you squeeze that out of the prop? It's better to eliminate cooling drag.

Norman Way in Stockton races a Pitts Special S1S at 234-235 MPH with a 180 HP engine and Catto prop. He also has an RV-4 with Whirlwind constant speed prop and his Pitts walks away from it. He spent a lot of time with cooling drag, little ducting for exit air, gap seals.

The scimitar tips are nice looking, but mostly a marketing gimmick. The tip is really important to efficiency within a narrow RPM range.

What's top RPM and true airspeed at that altitude. He knows what engine power and drag and can match thrust to achieve the spec. 5 knots is a big difference.

He's working with ECI on a firewall forward package for RVs. This came about because there are power pulse issues for their new 340 Titan engine. The electronic ignition makes minor changes in the firing timing and harmonics are a problem. Carbon fiber is extremely stiff, so it resonates worse than metal.

RV with 320 engine and metal prop has lots of vibration. 360 engine between 1900-2300 has vibration. Worry more about vibrations you can't feel. The old Thorp T18 had a cut-down prop to 66" and threw blades unexpectedly.

What about prop maintenance?

Start here – read the sticker on the prop, "7 inch crush plate required." He held up a prop where there was clearly a 6" diameter impression. Problems ensue.

There's a 2.25" hole in the center of the prop that is sealed with wax. That will erode over time so it's a good idea to rewax it to seal it. It encapsulates the moisture in the wood. But the grain opens up. Run some hot wax to reseal it. Paraffin candle wax is fine. It's same as what they do at the lumber mill to seal the end grain.

What about torque? Wood-only props have a very narrow margin for transferring the engine horsepower to the prop. The amount of pressure put on the prop is limited by what can crush the grain structure of the wood, so it's down about 18 pounds per inch.

The Catto is a composite prop with the glass carrying much of the load. The amount of torque that's required to transfer the horsepower safely into the propeller is still close to that of wood because the weight is the same, it's all about inertia. If you keep the inertial load and amount of torque that's required is less. He brings his torque value high – on 1/2" bolts he recommends 42 pounds, and 7/16" 35 pounds.

Because they encapsulate the moisture in the props, there's no place for it to go, and the prop material remains stable. You don't need to seal the bolt holes because they're not exposed – as long as it's on the plane.

Dave Dent warns that if you buy a prop and leave it sitting around the shop during construction, you should maintain the wax as it can erode from sitting there just as if it were flying.

The back side of the propeller will get nicks in it from stones thrown up. They use JP Weld on nicks. If it's bigger than thumbnail use flox.

The Catto prop is different from wood and metal in other ways. A prop strike doesn't shatter the prop like with wood. In Alaska they'll literally trim the end of the props with a hacksaw to match. A ground strike should have a runout check like with wood, but doesn't require teardown like metal. But that depends upon how bad you hit!

What about Jabirus – for example on the Sonex? The Brazillian race plane has a Jabiru 80 HP. Jabirus have an unusual torque pattern. They design at 3100 RPM, not 3300 RPM because they can't get optimum performance at the high RPM.

Does he test on testbed? It's not as much fun as flying it! Actually, he does static test the prop by running it at the design point to confirm it meets the spec. Based upon experience if it's in range the rest of performance curve should be OK.

What's comparison with MT? How can you match that? Catto built the prop for prototype Lancair IV for Dave Morrs. Craig told Dave that he wanted to race the MT at the Sun 100 he's using the wrong prop. So he did – and the 2 blade Catto was 25 mph FASTER than 3 blade MT at 1,000 ft MSL and became the first plane to break 300 MPH. Remember this is a race prop designed for racing.

But then they took the plane to Reno – 6,000 ft MSL flight altitude. Dave complained that at full throttle, 2700 RPM, it was like hitting a wall and to get more speed he'd have to increase the revs. Craig tried to explain that it wasn't designed for air that thin [reread earlier sections of this talk] and higher RPM was not a good idea until he could run the numbers back at his shop.

Craig went home that night, ran the numbers, called Dave's hotel and left a message, "take it off, don't run it!" Dave went out to the plane the next morning, kept the prop on but took off the governor. It ran fine until one blade departed. See YouTube video. Continental used the engine as destructive test platform.

Cool video's found on the internet.

Pratt & Whitney R-4360-20 First Start.

STOL, with all the bells and whistles.

What do you mean "Go Around"?

Let's just use ALL of the runway on takeoff.

What is it? From last month

Sponsored by:

Last month several people correctly identified the Varga Kachina. Our winner was Leland Collins. Multiple people earned points towards the year end prize.

Thanks to those that called Aircraft Spruce and mentioned this contest in the newsletter as they have agreed to continue their sponsorship. Prizes are available thanks to them. Please give them a call with your next order and tell them how much you appreciate their generous donation to our monthly newsletter.

Submit your answer to the newsletter editor to be eligible for a prize to be awarded at the regular chapter meeting.

You must be present to win but points are cumlative.

Winning entries will be decided by the email that is received with the earliest time stamp and the correct naming of the make/model of the pictured airplane as discovered. Winners that correctly identified the winning make/model that do NOT attend the meeting will forfeit the prize to the next available submission. Chapter Judge's decision is final on correct identification.

Winning entries will be decided by the email that is received with the earliest time stamp and the correct naming of the make/model of the pictured airplane as discovered. Winners that correctly identified the winning make/model that do NOT attend the meeting will forfeit the prize to the next available submission. Chapter Judge's decision is final on correct identification.

What is it?

Sponsored by: Aircraft Spruce & Specialty Co. SINCE 1965

If Airplanes Could Talk — EAA Chapter 663 LIVERMORE, CA — Lauren Paine Jr.

A checkout in a new type aircraft is an accomplishment to be proud of. It is also a time for caution. Nearly one-half of all aircraft accidents happen to pilots with less than 100 hours in type.

16610 Von Sosten Road
Tracy, CA 95304
jeffrylite@comcast.net or
President@eaa663.org