

SPORT

APRIL 2016

Aerobatics

OFFICIAL MAGAZINE of the INTERNATIONAL AEROBATIC CLUB



- **Aileron Rolls**
- **Judging the Hammerhead**
- **Infusing STEM Education in Aviation**



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I am going to focus on where and how to look and what you should see.

—Dave Watson

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COVER

Pitts historian François Bougie photographs fellow Canadian François Marquis flying his home-built Eagle.

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EDITOR'S LOG

BY REGGIE PAULK

Grassroots Aerobatics

The season is just getting started

AS I SIT WRITING TO YOU, THE snow is still flying outside my window—we received 10 inches overnight in the Colorado Rockies. A quick look at the IAC's contest calendar shows a very busy season ahead, so I have to wrap my head around the fact that many of you are already wearing T-shirts and shorts as you go about your business—not boots and heavy coats like me!

This year, the theme is "Grass Roots to the Top of the World."

There are a lot of things going on at the IAC as of late, and if you haven't checked out the website, or looked at our newsletter, you might be surprised with what's happening. Last year, we celebrated the 70th anniversary of the Pitts Special. This year, the theme is "Grass Roots to the Top of the World." For nearly 50 years, the IAC has been the organization to be involved in if you are interested in aerobatic flying in any of its forms. As it says on the IAC website:

"IAC began in 1970 with the goal of promoting "grass roots" aerobatics, that is, to bring aerobatics to the local and regional areas through chapters and regional competitions. It has also provided guidance to those who wish to learn aerobatics to improve their pilot skills and to gain the self-confidence and ability to control their aircraft in all flight regimes. IAC has promoted various safety and awards programs, sponsors the US National Aerobatic Championships every year, and administers the US Aerobatic Teams in both power and glider."

I've had the privilege of attending AirVenture since I took on this job back in 2008, and I have to admit that last year was one of the most exciting years to go. The redesigned pavilion is so inviting, and the organization was the center of attention in a way I've never witnessed at AirVenture. I'm hoping that this year's "grass roots" theme proves to be just as exciting, and I am already anticipating going back to see all of the people who are part of the IAC family and, more importantly, my friends.

IAC

Please submit news, comments, articles or suggestions to: reggie.paulk@gmail.com



PRESIDENT'S COLUMN

BY MIKE HEUER, IAC PRESIDENT, IAC 4

Marketing and Promotion

Success of branding in marketing

I HAVE BEEN A "TECHNICAL" KIND OF GUY all my life, and during my long career with the airline and in the military, I became entrenched in the world of procedures, checklists, systems, flying skills, and aircraft command. For several years, I taught those skills to other airline pilots and spent many hours in simulators and flying the line with new first officers and captains. It was a wonderful time.

I had no training in marketing and promotion when I first came out of college and into the work world, and only a commercial certificate and most of the required ratings to fly professionally. As the United States went through a protracted recession after the Arab oil embargo in 1973, an airline career became a distant goal, but I was lucky enough to be at an IAC board of directors meeting in the Milwaukee area in the fall of 1973, and at that meeting, Paul Poberezny pulled me aside and told me he would like me to join the EAA staff. I started there in January 1974 and was immediately immersed in all the complexity and variety of a nonprofit membership association where the work was different each and every day. I was there for four years and have never learned so much in my life—and it came at a time when I wanted to learn all I could. It was there I first came in touch with the importance of marketing, public relations, promotion, and communication. These were skills that required aviation experience if they were to be applied to my job but very new to me. It was a wonderful learning period that I value to this day.

In an IAC leadership role, you can seem very far from the cockpit—yet you can never do your job without that experience if you are to understand your members and what they need and require. But without expanding your skills beyond flying the maneuvers, you cannot successfully lead IAC and take it into the future successfully. I have enjoyed that challenge.

After I became president, we began a new marketing and branding effort that was carried out by our marketing chair, Margo Chase. Margo is a wonderful person to deal with, runs her own successful design firm in the Los Angeles area, and proposed to me that she do a brand audit of the IAC and produce a new brand guide for the future—with the new logo as its centerpiece. This work went on for a few weeks, and we announced the new logo and brand in our magazine in January 2015.

As an airline pilot, whenever we got a new CEO at the company, we would go through this drill. New paint schemes, new company logo, new crew uniforms, and so on. Some of it was not well-received and sometimes little understood by the employees on the line. But as time went on, and with my own work with EAA and the IAC in the background, I came to appreciate the importance of branding and image. In a profit-making enterprise, a brand and an image is important. It attracts customers, and when you seek to make your organization or enterprise of the highest quality, your brand should reflect that. This was my goal with the IAC—to make our organization the best we can, not only in terms of our image in the aviation community but in services to our members. That began with the new brand, and I was so delighted to have Margo working with our officers and directors to make it happen.

One of the many offshoots of the program was a redesign of our other logos, such as the Nationals and team brands, but also a launch of a new line of clothing and merchandise we call the "Unlimited Collection" and sometimes referred to as our premium line. That new line was introduced at EAA AirVenture last year in Oshkosh and was enormously successful, with many items sold out before the convention closed. We had quality material to offer. You can find this quality merchandise under the "Store" tab on our website, www.IAC.org.

Why is this important? Because other people notice—and the IAC stands out. This can lead to them coming into our pavilion, contacting us by e-mail, asking questions, and perhaps joining and getting some aerobatic instruction. Perhaps one day they will join a chapter and participate in a local competition. This is what grassroots means. But that has also been the road map for those who have successfully won slots on the U.S. aerobatic teams over the years—the "top of the world," as we call it in this year's AirVenture theme. All of our top pilots have wonderful life stories to tell—come to AirVenture this year to hear them.

Yes, it seems like a long way from the cockpit sometimes, and I enjoy that time as well. But sometimes it is the way to get people into a cockpit and show them the wonderful world of aerobatics that we live in. **IAC**

Please send your comments, questions, or suggestions to president@iac.org.



LINES & ANGLES

IAC to Create Membership Album With Harris Connect

As a result of requests from members, the International Aerobatic Club has partnered again with Harris Connect to create a 2016 membership album, a showcase of member stories and the sport's history. The last membership album was produced in 2000.

The album will list current IAC members and feature a member profile section in which folks can contribute stories and photographs to celebrate our sport and the impact it has had on their lives.

Members will receive a postcard in the mail and/or an e-mail requesting a brief telephone call, which will help ensure their listings are accurate. To be included in the 2016 membership album, members may call 866-216-4150, Monday through Friday between 8 a.m. and 10 p.m. Eastern time.

No purchase is necessary to be included, and members are not required to provide any information they would prefer not to share. The information included in the book makes it possible for members to see who of their peers has similar interests, aviation careers, geography, and more, as part of a networking opportunity.

All books are custom-ordered and not mass-produced. Sale prices begin at \$79.99 for softbound and \$99.99 for hardbound, plus applicable shipping, handling, and state tax may apply. Book orders must be placed by May 2, 2016. Members can order the book through the Harris Connect call center, 866-216-4150. All books will be shipped in late August 2016.

If you have questions or concerns, please e-mail pdeimersteineke@eaa.org.

IAC Creating Open Championship Medal

The IAC Open Champion Medallion is in the final stages of design. The front of the medal was designed by Colorado sculptor Pati Stajcar. The back was designed by Margo Chase. There's space on the back to engrave the year, category, and contest location. There will be a fundraising effort once the design is complete, so stay tuned.



2015 Fourth Quarter Achievement Awards Posted

Congratulations to the individuals below who have applied for and received Achievement Awards from flying in a non-contest environment (Smooth Achievement) or at a contest (Stars Achievement) in the fourth quarter of 2015.

As a reminder, first-time Primary or Sportsman Stars or Smooth Award applicants will receive their first award patch for free. Applicants for Glider or Power Primary or Sportsman Achievement Awards should fill out an application and only send payment for additional patches, pins, or decals. The first patch will be shipped at no charge.

Applications may be found at: www.IAC.org/legacy/achievement-awards-applications

Fourth Quarter Recipients

1200 Wayne Roberts - Primary Smooth
727 Malcolm Pond - Primary Stars
728 Wayne Roberts - Primary Stars
733 Iris Gruenwald - Primary Stars
734 Amy Yu - Primary Stars
915 Wayne Roberts - Sportsman Smooth
1538 Wayne Roberts - Sportsman Stars
1539 Zinnia Kilkenny - Sportsman Stars
509 Wayne Roberts - Intermediate Smooth
736 Wayne Roberts - Intermediate Stars
285 Mario Mena - Advanced Smooth
336 Michael Lents - Advanced Stars
337 A.J. Wilder - Advanced Stars
338 Wayne Roberts - Advanced Stars

All award recipients since 1970 can be found on the Achievement Award webpages:

Power: www.IAC.org/legacy/power-achievement-awards-home

Glider: www.IAC.org/legacy/glider-achievement-awards-home





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PHOTO BY EVAN PEERS, AIRSPACE MEDIA

Aileron Rolls

Seeing the perfect maneuvers

BY DAVE WATSON, IAC 26557



Photo 1: Start of the roll in Super D.

In the March 2015 issue of *Sport Aerobatics*, we began this series with instruction on how to use your eyes to see your way through an aerobatic turn. Let's move on to the aileron roll.

As I discussed in the lead article, I do not believe you can train your hands and feet to do aerobatics by reading how to do them and then training for those movements while stationary. Therefore, I am not going to emphasize what to do with the aircraft controls to perform these maneuvers; rather, I am going to focus on where and how to look and what you should see. Nothing in aerobatics can or

should be committed purely to "muscle memory." What I am going to try to do instead is help you train the fluffy back part of your brain to control your hands and feet while the lumpy top part of your brain stays the heck out of the way. I hope this article will help your eyes see the (nearly) perfect competition aileron roll so that your cerebellum can learn it and later make it happen on its own without your having to think (so much) while doing it.

Important note: Please don't try any new aerobatic maneuvers without a properly trained instructor or safety pilot on board.

A 'Roll' by Any Other Name

Throughout the aerobatic literature, there is a lack of consistency regarding the terms that define certain rolls. The IAC itself has inconsistencies between its definitions of certain rolls on its website and the definitions of those same rolls in the rule book.

Here's the IAC's description of an aileron roll on the organization's website at www.IAC.org/legacy/aerobatic-figures: "Aileron rolls are flown with the rudder and elevator in the neutral position during the roll. The aileron is fully deflected in the direction of the roll. This is the easiest of the rolls to fly. The ai-

leron roll is started by pulling the nose up to 20 to 30 degrees above the horizon. The elevator is then neutralized and the aileron fully deflected in the direction of the roll. The controls are maintained in that position till the roll is completed. After the roll is completed the nose is usually 20-30 degrees below the horizon."

Please do not be confused by this; that is absolutely not what is expected of an aileron roll in IAC competition, and it would score a 0.0 if flown as described. For this article, I am focusing on the roll that is described and expected to be performed in competition per the IAC rule book. According to the good book, aileron rolls come in two forms: slow rolls and hesitation rolls. This article focuses on the 360-degree full slow roll from upright on a horizontal line. Hesitation rolls are flown and judged exactly as slow rolls but with added stops of rotation at defined cardinal points, so I use the term aileron roll (the broader category) for this article since these described techniques apply to both the continuously rotating slow roll and the hesitation roll.

The Competition Aileron Roll

As simple as an aileron roll may sound from the description on the IAC website, the competition aileron roll is a very complex and uncoordinated maneuver. Unlike air-show barrel rolls or ballistic rolls (or rolls that have been inappropriately described on the web), the aileron roll must be performed at a constant altitude and on a straight flight path. For this article we are going to focus on the full slow roll from horizontal upright—the cornerstone maneuver of Primary and Sportsman and the building block for all the other rolls (except snap rolls).

The IAC rule book requirements for a perfect aileron roll:

The roll starts on heading at wings-level horizontal flight.



Photo 2: First knife-edge of roll.

You must maintain a constant rate of roll throughout the required rotation (360 degrees).

You must maintain a constant altitude.

You need an unchanging flight path (not to be confused with fuselage heading).

The roll stops on heading at wings-level horizontal flight.

The judges primarily will be looking for the flight path of the plane's CG to remain at constant altitude and moving along a straight line (on heading). This requires that the pitch attitude of the plane be constantly changing throughout the maneuver, but the flight path must remain constant. The amount of pitch change is totally dependent on the type of aircraft being flown and its airspeed. For this article, I made video clips of three different types of planes: a Super Decathlon, a Pitts S-2B, and a semi-high-performance monoplane (Lazer 230). In the interest of space, the photos in the article are taken from the Decathlon video, but you may find the videos at the following links:

Super D: <http://youtu.be/zlaaZ4krgO0>

S-2B: <http://youtu.be/UIFvNl1qhnQ>

Lazer: <http://youtu.be/tNtW2zKsVGA>

These videos may help you understand what you should see when each of these planes does a

roll. Note that the rolls in the Lazer were done at approximately one-half aileron deflection for the benefit of the viewer.

Description of the photos:

Photo 1: Start of the roll in Super D

Photo 2: First knife-edge of roll

Photo 3: Inverted

Photo 4: Second knife-edge of roll

Photo 5: Finish position

First Things First: Straight-and-Level Sight Pictures

The first things you should train your eyes to see are the straight-and-level (S&L) upright (should be the same at the start and the finish) and the S&L inverted sight picture (halfway through). Before you start a roll, ensure that you can fly S&L at constant altitude. When you're beginning to learn the roll, you should attain maximum cruise speed at whatever power level you are comfortable with (usually full smash for competition aerobatics). This way your sight picture should be very consistent every time if the airspeed is consistent. Also, set the elevator trim to a position appropriate to your plane. If you are flying a Citabria or other flat-bottomed wing, you should apply some nose-down trim. If you let go of the stick, the nose should drop smartly 5 to 10 degrees in a couple of seconds.

In a high-performance mono-



Photo 3: Inverted.

plane, you should trim for neutral elevator. Depending on the angle of incidence and airfoil symmetry, every plane should be somewhere between those two extremes so that inverted flight does not take significantly more stick force than upright. In my Super D, I dive to 160 mph and set the trim for neutral; this standardizes the trim for all

enough to have some low, distant clouds, pick one dead ahead of you and fly straight at it. Keep looking at this point, not at the nose or spinner. The reason we are not going to stare at our spinner is that it is going to translate the resemblance of a circle around the world in front of you as roll, and you do not want your attention to follow

In your mind's eye, imagine a string emerging from between your eyes and extending tightly to that cloud in front of you.

loads and weather conditions. Set up your "standard" trim condition in your plane and memorize where the nose is in relation to the horizon directly in front of you, and make sure you are maintaining consistent altitude (one eye on the altimeter).

Use whatever sight mechanism helps you to see and memorize exactly how far below the horizon the nose is as you simply maintain straight-and-level flight at that max cruise airspeed. The key here is to look (focus but don't tunnel in) in the distance, above the horizon approximately the same height as you are above it. If you are lucky

it or it will draw you off your goal, which is to keep going straight!

In your mind's eye, imagine a string emerging from between your eyes and extending tightly to that cloud in front of you. Just like when you played telephone with two cans and a string as a kid (yes, that certainly dates me), you will hear the word "10" echoed back to you if you can keep your flight path and line of sight along this string, keeping it straight and tight. The angle between your imaginary string and the nose is a very important aspect, and you need to be able to see and duplicate this

angular measurement over and over. Now that you have memorized the "nose attitude" start position, consider that your airspeed is not going to change much within the next few seconds (if your roll is clean and not too draggy), so one requirement for your "perfect" roll is that you are going to end with the aircraft's nose in exactly the same place as it started (at the same distance below, and pointing at exactly the same feature on the distant horizon). We now know our start and finish attitudes.

Constructing Your 'Sacred Oval'

The next attitude you need to see is the S&L inverted position. You will be inverted at the half-way point in this roll, so this attitude is your "target" for the first half of the roll. Roll your plane to inverted (any way you can at first) and hold it there for a moment at inverted S&L. Check your altitude while inverted and make sure it has not changed and is not changing. If you are descending, push the stick a bit harder, or stop pushing so much if you are climbing. Do this many times before you try to make a full IAC-rules aileron roll. Once you have determined the proper attitude for straight-and-level inverted flight, take note of how far above the horizon your nose is. Contrast this with its position at upright. Compare those angles (imaginary string to the nose at upright and inverted). Also take note of how hard you had to push the stick to hold inverted. This can be a lot of push in planes with non-symmetrical wings! Okay, now we see our starting, inverted, and finish attitudes.

Imagine now that you are at the first knife-edge (right wing high), are still looking down (in relation to you) at your nose, and yet your string is still tight to the horizon in the distance. Your nose must therefore appear right of your original heading (string) if you are still flying along the same flight path.

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Photo 4: Second knife edge.



Photo 5: Finish position.

In general principle, it should appear just as far to the right of your original heading as it was below it in your original upright S&L sight picture. This amount will vary from plane to plane (and according to your sitting height above your nose). Also, your nose attitude must be higher (in relation to the horizon) than your starting attitude because: 1) you need fuselage lift so you don't descend, and 2) your changing attitude throughout the roll must be performed smoothly—the nose needs to get from below the horizon (typically) to that inverted attitude with the nose above the horizon in a nice, smooth fashion.

By knife-edge, the nose attitude should also have shifted up (lifted) approximately half as much as it needs to in order to achieve

the height above the horizon as it would need to for the S&L inverted position. The second knife-edge point should be a mirror image of the first, with your string defining the plane of the mirror. The astute observer may notice that in these pictures, the nose height for the second knife-edge is higher on the horizon than for the first. Although my rolls in these examples are not perfect, this is actually a parallax artifact from the camera being mounted on my right ear cup. If your eyes are mounted directly on the centerline of your airplane, these views should be mirror images of each other. In a Cessna Aerobat or other side-by-side plane, the view will not be symmetrical. There are other artifacts resulting from the camera's failure to perfectly align with my eyes, but this

is the most noticeable.

Now that we have the sight picture for essentially all the cardinal points, a perfect aileron roll will connect them with the smooth, blended transitions of a vertical oval. Oval, you say? Not a circle? Sacrilege! Well, yes, a circle. Maybe. A circle is an x-y symmetrical oval. Our nose in our roll will only transcribe a perfect circle if the plane we are flying has exactly the same S&L inverted angle of attack as it has upright (i.e., a fully symmetrical wing mounted without angle of incidence). Does your plane have both of those? If not, your nose is likely considerably higher (in relation to the horizon) inverted as it was upright, so it will construct an elongated circle (i.e., oval) as it connects the dots of the cardinal points we described. Right? Now you can do a roll in your mind's eye and follow along with the pictures and videos. Don't try to memorize stick movements; just memorize what you need to see.

Let's Do One

Moving on to our aerobatic aileron roll, we are back in our plane at altitude, our safety pilot is on board, our parachutes are on and legal, and we have cleared the area. I am assuming you have plenty of flight time in your aircraft, so you should know what happens when you push or pull the stick or press on a rudder. Remember, you are fixed solidly in the airplane; those same straight-and-level control inputs will make the plane react in relation to you regardless of where the horizon is in your sight picture. Do not stare at the spinner or the top of your cowl; use the full range of your vision and keep the whole world in front of you in perspective.

Just like when you drive a car, you don't (hopefully) stare at the ground in front of your bumper. Look as far in the distance as you can and aim your machine with "big eyes," not tunnel vision, drawing that string to infinity. Take a quick

look at the altimeter and get your start altitude. Now forget about the stuff inside the cockpit for five seconds (or one-third of a second in a Giles). You and the plane are one and the world will pass through and around you smoothly.

Initiate

The first movement in the aerobatic roll is initiated by a crisp full deflection of the ailerons to the stop. At first, try to keep the elevator pressure as it was for straight-and-level flight. As you roll, keep your vision in big-eyes mode. Do not let the rapidly changing sight picture allow your vision to tunnel in or follow the spinner, as it will instinctively. If you keep a wide-angle vision (like the GoPro does), you will see a few things. The horizon will go up on the left (you are rolling that way), and your nose may lift a bit and shift to the right (consequences of adverse yaw).

At the very beginning of the roll,

the wings are still pretty much level, so the right-wing-back adverse yaw will initially draw your nose (and flight path) off, heading right of course. This is not good (hence adverse!). As the plane starts to roll, that right adverse yaw will eventually be in the upward direction (as you approach knife-edge). This becomes a good thing; remember, you need your nose up.

Use whatever control inputs are necessary to get to that first cardinal point, keeping the string tight and your flight path on heading during the roll in. This may require a momentary touch of left rudder at the initiation of the roll to defeat that initial nose-right yaw. But very shortly thereafter you will want to let the nose go up in relation to the horizon and right in relation to your sight picture (string or original heading). Let adverse yaw do most of the work for you. As we discussed, your nose must move to the right of your heading (as you

view it) because you are typically looking down at your nose when in S&L flight. Most importantly, so long as you keep your attention focused (but not with tunnel vision) on the distant horizon, the world should roll directly along your line of sight (keeping that string tight), with the center of rotation not shifting at all directly along the path of the CG of your plane (your eyes are generally close enough).

In a Super D or Citabria (and many other planes, I suspect), the adverse yaw may not be enough to get your nose going up fast enough to get you to your first and inverted cardinal points. You may need to initially compensate for the brief left rudder with a slight and brief "tug" of aft elevator to help the nose start going up around that oval. If you find this helps to hold the string straight, make darn sure you do not do that tug until the roll has started. If you tug first, you are initiating the roll in an ascending flight path (i.e.,

NOMINATIONS AND ELECTION 2016

The Nominating Committee for the 2016 IAC election has been named and consists of chair Lynne Stoltenberg, Doug McConnell, Bob Hart, Tim Just, Bruce Ballew, Michael Steveson, and Mike Rinker.

Nominations for officer and board positions can be submitted at any time. Forms and requirements can be found on the IAC website at <https://www.iac.org/legacy/iac-leadership>. Membership sign-in is required. Important dates for the 2016 election are as follows:

- IAC Annual Membership Meeting, Oshkosh, Wisconsin – 0830 CDT, Friday, July 29, 2016
- Nominations Close – April 5, 2016
- Balloting Begins – No later than June 29, 2016
- Balloting Closes – 1800 CDT, Monday, July 25, 2016

The method of voting in 2016 will be electronic only.



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If all else fails and you just can't seem to get it to look right (and you have no access to someone qualified to fly with you), take a video camera and duct-tape it to your head like I did.

“ballistic” roll), and the judges will punish you accordingly.

Focus your attention straight ahead with big eyes, use only as much rudder as it takes to keep that sight picture pointing at your reference point, and let adverse yaw and your brief tug and minor adjustments bring the nose up and right of your sight picture as you watch the world before you purely rotate without shifting as you approach first knife-edge. As we proceed through the roll, the amount of lift on the wings will vary tremendously from plus 1g to 0 to negative 1g to 0 and back to plus 1g. This is going to require significant elevator-pressure changes throughout the roll, too.

Try not to cock your head in an attempt to keep it level with the horizon. In these photos, the camera was mounted to my headset's right ear cup. Note that my head does not shift much in relation to the inside of the plane; tilting your head to keep your eyes level with the horizon hinders your ability to keep your physical orientation with the plane intact, and unless you are demonically possessed, you just don't have enough range of motion to do this is a roll! I find it impossible not to tilt my head somewhat, but you should try to minimize it.

You now see the horizon approaching 90 degrees, the nose has risen, and the sight picture ahead has you still pointing directly at your original start point but slightly higher. At knife-edge, the wing must be at zero lift or you will be driving left of heading (with any re-

sidual back-stick) or right of heading if you start pushing too soon. Just keep that distant object (cloud) directly in front of your eyes, and don't let some involuntary push or pull (that your cerebrum “thinks” it needs) of the stick allow it to move. At this knife-edge, your nose is up, your wings are at zero lift (0g), the aileron is full over, and our cloud has not moved. Life is good!

Keep Her Rollin'

After first knife-edge, the wing(s) will start to move upside down. You must start to load negative g on, because at inverted you must be at negative 1g. Do this smoothly. Start to apply that forward stick, remembering how hard you will ultimately need to push at the inverted S&L attitude (you memorized this in your earlier flights). Get to that degree of push smoothly as your eyes watch the rotation of the world bring you to the inverted cardinal point. (Unfortunately, smoothly is not linear. All the transitions on the control surfaces during a roll are generally sinusoidal, not linear, but you will figure that out by maintaining your sight picture and not from the math).

At inverted, you know the attitude and the stick and rudder forces from the inverted S&L activities described earlier. You are at your maximum (the amount you need for inverted S&L, not full forward stick) forward elevator pressure (hopefully at negative 1g). Your sight picture and fuselage heading must be aligned with your initial heading, so you must ap-

ply a touch of left rudder (to compensate for the right adverse yaw). Ailerons are still hard to the stop. Keep going; now it gets interesting.

Once the rotation goes past inverted, the adverse yaw that helped get the nose up wants to drive the nose and your sight picture down into the brown stuff, but you want to keep it up in the blue for a while yet. So do what your eyes tell you; start kicking that left rudder in harder as you approach second knife-edge. If you are now confused about which rudder is left (as I often am), it's the one in the blue (top rudder). In fact, at second knife-edge in a Super D (or similar), you may want more left rudder than your plane can give you. You may find yourself at the stop; this is normal.

You are back to knife-edge, so that means zero lift on the wings. The amount you were pushing to be inverted must have diminished to zero or you would see your nose pushed or pulled off heading as we discussed with regard to the first knife-edge. Keep that string tight and straight. If your nose is still in the blue and a little to the left of your original heading, you are doing great. Now you have to get to your upright S&L attitude with the original starting attitude and stick forces as the roll finishes.

You have to start getting off that left rudder and start loading the wing smoothly back to plus 1g right as you hit wings-level. The moment you hit wings-level, don't forget to yank your ailerons back to neutral to stop your roll. Do not anticipate the “roll out” by more than a few degrees. Your plane should stop rolling abruptly as you unload the ailerons. Anticipation will slow the roll rate at the finish—judges are attuned to this. Keep flying S&L and immediately look at your altimeter (and other instruments, to make sure all is well). Compare your altitudes at start and finish. If you are at or within a few feet (+/- <25 feet) of the start altitude, you nailed it. Fun! Otherwise you need to make corrections.

Some Last Tips

If your roll is “barreling”: Chances are you are doing too much of something at the wrong time—for example, pushing too hard or too soon, holding back-stick through the first knife-edge, applying too much top rudder on the first half of the roll, etc.

If your roll is “dishing”: If you find the nose getting below your start attitude in the last quarter of the roll, you are either not getting in enough forward pressure at inverted or not enough top rudder in the second knife-edge (or both). Don’t just yank on your controls at the end of the roll to correct this. Try again with a little more push or more left rudder. Once you get to the point where the world just spins on your nose like a phono record (dating myself again), you know you have mastered the aileron roll.

If all else fails and you just can’t seem to get it to look right (and you have no access to someone qual-

ified to fly with you), take a video camera and duct-tape it to your head like I did. If you play it back in slow motion, you can probably figure out what you are doing wrong by watching when that imaginary string gets catawampus and that spot on the horizon goes somewhere other than straight ahead! Note: The farther the camera is from your eyes, the more the point in the distance will move as an artifact since the camera is rotating about the line of sight (string), too.

One other really good way to develop hand-eye skills for these rolls is to do Dutch rolls, or more correctly, as I like to practice, half-Dutch rolls. In this exercise, achieve straight-and-level full-throttle attitude as described earlier, and then bank to 45 degrees and, without any heading, change bank oppositely back to wings-level, straight-and-level flight. Do not bank on through to the other side as you would in Dutch roll; stop at straight and level

with the nose having not varied in heading at all and finishing exactly where it started.

As your skills progress, increase the bank to at least 60 degrees, then 90 degrees, and then back to wings-level while always keeping the line of sight on heading as described here. Practice the half-Dutch rolls in both directions equally. When doing them to the left (left aileron to start), you are teaching your eyes to see the start of the roll (before you reverse back). When initiating them with right aileron, you are teaching your eyes, hands, and feet to stop the roll as you finish back to S&L. Doing these half-Dutch rolls will better teach you how to see and feel the start and to finish elements of the roll more efficiently, and if kept to within the limits of non-aerobatic flight, they can be practiced at almost any time, thus training your eyes and cerebellum to control the plane without your having to think too much about it. **IAC**

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Judging the Hammerhead

Taking a closer look

BY JOHN MORRISSEY

IAC 3238

ASSOCIATE MEMBER OF THE SOCIETY OF EXPERIMENTAL TEST PILOTS

I believe understanding the term “center of gravity” may be one of the problems that can cause a bit of difficulty when grading the pivot.

I have never been completely comfortable with our IAC criteria for judging the pivot in the hammerhead. I became a regional judge in 1976, a national judge a few years later, a CIVA judge in the '90s, and I have been teaching judging schools since the early 1980s. Even back then, I had a feeling that something was not quite right about our CG (center of gravity) “wingspan displacement” method.

Essentially, our rule book says that, during the pivot, the displacement of the CG must remain within a distance equal to one-half wingspan radius to avoid a downgrade. I believe understanding the term “center of gravity” may be one of the problems that can cause a bit of difficulty when grading the pivot. The term CG, while very necessary in an aerodynamic sense, can be misleading when used in the practical sense for subjective judging, as it can mean too many things to too many people. For one thing the CG can change during flight. For another it has no defined reference point on the aircraft. It cannot be referred to visually during the pivot. It is an aeronautical engineering term used for aircraft design and operation.

For purposes of judging aircraft in flight, I believe we would be better off with a pilot's term such as the yaw axis. Actually the term yaw axis is also used in our rule book when describing the pivot. That term just makes sense. We pitch about the lateral axis. We roll about the longitudinal axis. So why not

pivot about the yaw axis? My suggestion then is to use only the term yaw axis when explaining judging criteria for the pivot.

Further, the IAC rule book says: “Ideally, the aircraft would come to a *complete stop* [author emphasis] at the top of the hammerhead and pivot around its *stationary* center of gravity.”

Really?

Of course, this is impossible unless we can arrange for Mr. Newton to repeal his law of free-falling objects. While there is additional wording that seems to allow the pivot to begin before the “complete stop,” the blanket statement beginning with the word “ideally” has created the impression in many, if not most, of our judges that the aircraft must stop, pivot within one-half of its wingspan, and head downward on a vertical line. The current criteria for judging the hammerhead can be reviewed, if desired, in our IAC rule book on pages 8-14 (6).

I have given that whole concept more thought over the years and finally decided to apply some science and empirical data to help me understand my discomfort with our existing pivot judging criteria.

The first step, of course, was to define the sources of the disquieting aspects I felt with our method of judging the pivot. It did not take long to realize that the apparent size of the aircraft, especially at altitude in the far third of the box, would have a major effect on how well the aircraft could be seen and evaluated by the human eye at a

slant range of nearly seven-eighths of a mile. This took a while to sort, but without bothering our readers with the math, suffice it to say that an aircraft with a 20-foot wingspan (all Pitts S-2 variants) will appear to be about 3 inches in size to the judges. For example, if one had a 3-inch model of a Pitts in hand and held it at arm's length with the top, or bottom, of the aircraft facing the judges, it would replicate the apparent size of the aircraft 800 feet from the far boundary of the box at 3,500 feet. Closer to the judges at 1,500 feet in the near third of the box, the apparent size increases to 6 inches.

Well, that is not a very large object, is it? And it is even a smaller silhouette if judges are looking at the side profile when the aircraft is flying on the X-axis as the pivot occurs. Riding that horse a bit further, it is obvious that the wingspan displacement method becomes most effective only if the aircraft's plan view can be seen by the judges as the pivot occurs.

Another factor associated with my discomfort regarding the wingspan displacement method is that it is impossible to apply accurately if a side wind is present during the pivot. In that case, wind drift will obviously increase (or decrease) the apparent wingspan/yaw axis displacement. This effect, coupled with the small apparent size of the aircraft, hinders accurate assessments of such wing displacement comparisons.

Other factors become intuitively self-evident when one looks ratio-

nally at the mechanics of the issue. For instance, aircraft with a faster yaw rate in the pivot (i.e. a Pitts), will have less wingspan displacement than aircraft with slower yaw rates such as the Extra, Stephens Akro variants, or the Sukhoi that produce greater displacements. And the quality of all of those different hammerhead pivots can still be perfect regardless of their yaw axis/wing displacement differences. The obvious conclusion then is that the wingspan/yaw axis displacement method comes up short as a grading criteria for the pivot.

As judges, we are, or should be, measuring pilot skill, not aircraft yaw rate capability.

I believe here may be the place to introduce a truism about hammerheads that those just beginning to hone their aerobatic skill sets may not find intuitive. The aircraft *does not* come to a complete stop and then begin the pivot. If that does happen, it will be “sliding backward” from the instant the pivot begins unless, sorry for the repetition, we can arrange to repeal Mr. Newton’s equation ($\text{Distance} = 1/2 \text{ Acceleration Rate} \times \text{Time Squared}$) that covers the distance traveled by a falling object. Or, in our case, how far an aircraft will “fall” if the slide begins with the pivot.

What really happens in a proper pivot is that it must be initiated at a speed (about 50 kph in a Sukhoi or 25 mph in a Pitts) that will allow the aircraft to pivot 180 degrees and finish at the same altitude as it began. If the nose of the aircraft is below the level plane vacated by the rudder of the aircraft where the pivot began, there is a visually verifiable error in the hammerhead pivot that can be seen by the judge from any distance in the box no matter the wind or axis of the pivot.

Example: If the pivot is initiated with insufficient speed, a “slide” will begin somewhere in the pivot before its completion and the nose will be below the beginning plane vacated by rudder. And if the pivot

occurs above the correct pivot speed, a slide will also begin somewhere in the pivot, causing the aircraft to finish lower than it started the pivot. This is not a typo. If one pivots too early, the vertical stabilizer will be at a higher speed and much more effective in doing its main job of yaw control. Therefore, the time in the pivot will be significantly increased. And since T , the time function in the falling object equation, is “geometric/squared,” it gets to be the dominant vote in determining the altitude lost during the pivot.

Ergo, there can only be one correct speed to begin the pivot that will allow it to be completed on the same level plane that it began. If the nose finishes lower than that plane, the judge could estimate the angle between the rudder’s position at the beginning of the pivot and the nose position at the end and apply our traditional one point for 5 degrees of perceived error; alternatively, fuselage lengths below the starting plane of the pivot could also be used as in our traditional use of fuselage lengths in tails slides and rotational elements following half-loops.

Therefore, I believe the most effective way to judge the pivot in the hammerhead is to say it must be completed with the nose of the aircraft on the same level plane vacated by the tail when the pivot begins.

Of course, one must apply the usual deductions for any movement in pitch and/or roll during the pivot that are not that difficult to see and assess.

Now, let’s consider the benefits of using the “nose replacing the rudder’s plane” procedure: It allows us to eliminate yaw rate and lateral wing/yaw axis displacement from the grading criteria of the pivot portion of the hammerhead. It also allows us to grade a hammerhead whose flight path is on the X-axis as well as we can on the Y-axis. And it lessens the effects of parallax on

hammerheads performed at the ends of the X-axis.

The method in our IAC judging schools and rule book was a good start more than 30 years ago. But I believe the time has come to update the way we judge the pivot.

Perhaps some full disclosure is now in order on this subject. Ellen Dean, Pete Anderson, Patty Wagstaff, and I visited the Soviet training camp at Borki, Russia, in October 1991. They were gracious hosts who shared their experiences, aerobatic knowledge, and techniques with us. This was the first formal exchange between Soviet and American aerobatic pilots and their trainers. The stories of that exchange were well covered in *Sport Aerobatics* in three, I believe three, issues during 1992 when Mike Heuer was our editor. We spent three full weeks flying with the Soviets. And I spent several hours with one of their trainers and judges, Sasha Shpigovsky. I still have my notes from those conversations with that wonderful man. In 1991 I had just been selected team trainer for the 1992 WAC at Le Havre, so I was very interested in learning Soviet judging concepts. It was Sasha who pointed out to me that they used the rudder/nose comparison at the beginning and end of a hammerhead as a major factor in judging the pivot. After that visit with Sasha, I watched carefully as the Soviets practiced. Just like he said, their nose replaced the vacated rudder’s plane. When that failed to happen, it was “mentioned.” In 1997 Sasha and my dear friend Kasum Nazhmudinov, the trainer of the Soviet and Russian teams for 26 years, stayed at our house after the 1997 AWAC in Lawrence, Kansas.

I learned a great deal about competition aerobatics from Kasum. He asked me not to keep it a secret. I have tried to do as he requested by passing his competition-based trainer’s wisdom on to those I have trained.

IAC



Infusing STEM Education in Aviation

An update on activities

BY DAVID MANUEL, IAC #437085

In “The (Re) Making of a Skybolt Dream!—Part 1,” I shared SkyBatics’ vision to partner with a local high school school district in Silicon Valley and create a dynamic STEM-focused (STEM being the acronym for science, technology, engineering, and math) aircraft-building program. At the time of that writing in April 2015, Sky-

Batics had only just incorporated as a nonprofit in the state of California. In many ways, the SkyBatics dream in the April story last year was still just that—a dream. As a new startup, there were no board of directors, connections, or partnerships; no identity in the form of a website or corporate logo; no funding; and no IRS 501(c)(3) ap-

proval or state of California tax-exempt status. However, in less than a year since Part 1 was published, much has changed—including the title of this updated story.

Immediately after incorporating in March, Chris Bledsoe, SkyBatics secretary and life-long friend, and I began the task of putting together a board of directors.



SkyBatics' booth at San Carlos' annual Airport Day in 2015.



Chris Bledsoe sharing the SkyBatics dream with event participants.

Not an easy task! Several well-qualified candidates I had in mind had, well, other things in their minds. I asked Beth Stanton to consider joining the board; she graciously declined (after “sleeping on it”), given her increasing workload and demand on her time with expanding roles and responsibilities locally, regionally, and nationally. Beth did, however, represent SkyBatics at AirVenture 2015 in Oshkosh, and has been one mega-supporter and promoter of SkyBatics. And for her efforts and support, we are grateful!

I am so very proud of our leadership team, even humbled to lead this group of people. Four of us are pilots holding various ratings. Passionate and driven by a shared vision, we are diverse and bring substantial academic and career experience and success to the table. SkyBatics board of directors includes:

David Manuel, President

Daniel Ruiz, Treasurer

Ana Uribe-Ruiz, VP Program Development

Chris Bledsoe, Secretary

Kent Burke, Director at Large

After the board was formed, I turned control of the organization over to the board at our first meeting in May. We then began to focus on these three objectives: (1) complete IRS Form 1023 and submit for federal 501(c)(3) approval; (2) create a strategic partnership with at least one local high school District; and, (3) create/launch a fundraising campaign.

Airport Day

Gretchen Kelly, San Carlos Airport (KSQL) manager, invited SkyBatics to participate in the annual San Carlos Airport Day on June 27. In preparation for the event, we had brochures printed, a banner made, and planned free giveaways and a drawing. We had a great time meeting the general public and talking about SkyBatics’ plans; there was a lot of interest, with many people signing up to receive additional information as our plans unfold and take shape.

Attacking objective No. 1 in June, we began the arduous task of completing the 501(c)(3) IRS Form 1023—a 31-page editable PDF document PLUS plus a 12-page supplemental attachment. After working on the document for more than a month under our attorney’s guiding hand, the paperwork was submitted to the IRS in July; expected wait time was estimated at between four and nine months! Much to our delight, the IRS date-stamped our approval on September 30, 2015—only 10 weeks after the application was submitted. Additionally, the state of California granted us tax-exempt status in January, completing the entire application approval process for 501(c)(3) and tax-exempt recognition. SkyBatics can now accept tax-deductible donations.



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SkyBatics president David Manuel and VP of program development Ana Uribe-Ruiz at the SVCTE campus.

The MetroED Connection

With objective No. 2 in mind in July, Ana was able to arrange a meeting with former colleague Erik Burmeister, assistant superintendent of the Menlo Park City School District. Meeting with Erik seemed to be our best shot at getting our foot in the door and creating an opportunity to partner

with a local school district. And this is where the tables began to turn! Erik strongly suggested that we connect with MetroED in Santa Clara County and offered to provide a personal introduction to MetroED's superintendent, Alyssa Lynch.

MetroED, located in San Jose, operates the Silicon Valley Ca-

reer Technical Education (SVCTE) campus, which serves six high school Districts districts and 35 High high Schools schools in Santa Clara County. The faculty and students (high school juniors and seniors) at MetroED are remarkable—enthusiastic and passionate about their respective programs. The 29 current pro-

grams range from accounting and financial careers to veterinary assisting, including carpentry, film and video production, fire science/first responder, forensic investigation, health occupations, Internet engineering and truck mechanics. However, noticeably absent from the 13 career sectors were any offerings related to aviation.

In September, Ana and I met with Alyssa and Jodi Edwards-Wright, MetroED/SVCTE's director of instruction and accountability. By the end of our meeting, we had established a conditional partnership pending the successful completion of a feasibility study that supports moving forward. Ana and I had to contain ourselves from commencing a jumping high-five in the parking lot, but we probably should have busted one out anyway. Our meeting exceeded our expectations, and we're grateful to have such an incredible partnership opportunity. This is HUGE for SkyBatics!

Outreach to AOPA

In October, Ana arranged for yet another meeting (Ana's the make-a-meeting-happen guru!) with AOPA's Stephanie Kenyon, VP of strategic philanthropy, and John Morrison, director of development, western region. Stephanie and John happened to be in the San Francisco Bay area, so the timing was perfect. Over lunch, we were able to share about SkyBatics, our vision, and the progress we've made thus far. Eager to provide additional support, Stephanie and John offered insights and a willingness to provide resources and connections nationally that will help to advance our efforts.

Our Most Recent Happenings

During the first week of January, another meeting was held at MetroED/SVCTE, this time to include Sharon Brown, the school's

principal. As hoped for, we are moving forward with plans to create and launch the STEM aircraft-building program at the start of the 2017-18 academic school year.

In January, SkyBatics hosted an online logo design contest with 99designs.com, based in San Francisco. With more than 300 logo designs submitted from graphic artists around the globe, we finally narrowed the competition down to six designs, with the board voting on this one, a compelling and blended display of aviation, aerobatics, and STEM education.

In February, we launched our website, www.SkyBatics.org. There, you can learn about each of the Board board members, SkyBatics' mission, what we've been up to, and where we're headed. Through the website, you can also make an online donation or contact us if you want to contribute your talents and skills in any way. Please check it out—and give us some feedback. We'd love to hear from you!

As we move forward, we are turning our immediate attention to the creation of a promotional video and fundraising efforts. We plan to incorporate crowd-funding on Indiegogo as a part of our fundraising strategy. In the meantime, we ask you to consider making a direct contribution to SkyBatics. Our website has all the details.

We cannot wait to get this program fully developed, up and running, and having high school students building airplanes! For more information, questions about donating, or other inquiries, please contact Daniel Ruiz, SkyBatics' treasurer, at Daniel@SkyBatics.org, or David Manuel at David@SkyBatics.org. By the way, you can also follow/like us on Facebook and Twitter (www.Facebook/SkyBatics.com and [@SkyBatics](https://twitter.com/SkyBatics)). We appreciate your support and look forward to more good news in our next story!

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CONTEST CALENDAR



Mark your calendars for these upcoming contests. For a complete list of contests and **for the most up-to-date calendar, visit www.IAC.org**. If your chapter is hosting a contest, be sure to let the world know by posting your event on the IAC website.

Hammerhead Roundup (Southwest)

Friday, April 8 – Saturday, April 9, 2016

Practice/Registration: Thursday, April 7

Power: Primary through Unlimited

Location: Borrego Valley Airport (Lo8): Borrego Springs, CA

Contest Director: Kevin Elizondo

Phone: 562-577-5776

E-Mail: kelizondot@yahoo.com

Website: www.iac36.org

Carolina Boogie (Northeast)

Friday, April 22 – Saturday, April 23, 2016

Practice/Registration: Thursday, April 21 – Friday, April 22

Power: Primary through Unlimited

Location: Wilson Industrial Airport (Wo3): Wilson, NC

Contest Director: Eric Sandifer

Phone: 919-605-9585

E-Mail: n100omp@yahoo.com

Website: www.facebook.com/

Sebring Spring (Southeast)

Thursday, May 5 – Saturday, May 7, 2016

Practice/Registration: Saturday, April 30 – Wednesday, May 4

Glider Categories: Sportsman through Unlimited

Power: Primary through Unlimited

Location: Sebring Regional Airport (SEF): Sebring, FL

Phone: 561-644-1312

E-Mail: donchartmann@yahoo.com

Gulf Coast Regional (South Central)

Friday, May 13 – Saturday, May 14, 2016

Power: Primary through Unlimited

Location: Jackson County (26R): Edna, TX

Duel In The Desert (Southwest)

Friday, May 13 – Saturday, May 14, 2016

Practice/Registration: Thursday, May 12

Power: Primary through Unlimited

Location: Apple Valley Airport (APV): Apple Valley, CA

Contest Director: Chris Olmsted

Phone: 831-334-7232

E-Mail: chris@olmstedeaviation.com

Ben Lowell Aerial Confrontation (South Central)

Saturday, May 21 – Sunday, May 22, 2016

Practice/Registration: Friday, May 20

Power: Primary through Unlimited

Location: Sterling Municipal Airport (tentative) (STK): Sterling, CO (tentative)

Contest Director: Bob Freeman

Phone: 303-709-6465

E-Mail: 2bafree.man@gmail.com

Website: www.iac12.org

Hoosier Hoedown (Mid-America)

Saturday, May 21 – Sunday, May 22, 2016

Practice/Registration: Friday, May 20

Power: Primary through Unlimited

Location: Kokomo Municipal Airport (OKK): Kokomo, Indiana

Region: Mid-America

Contest Director: Mike Wild

Phone: 765-860-3231

E-Mail: mike.wild@hotmail.com

Website: www.hoosierhammerheads.com

Armed Forces Memorial (Southeast)

Friday, May 27 – Saturday, May 28, 2016

Practice/Registration: Thursday, May 26

Glider Categories: Sportsman through Unlimited

Power: Primary through Unlimited

Location: Grenada Municipal (GNF): Grenada, MS

Region: Southeast

Contest Director: Michael Tipton

Phone: 573-922-9600

E-Mail: michael.tipton@hotmail.com

Salem Regional Aerobatic Contest (Mid-America)

Friday, June 3 – Sunday, June 5, 2016

Practice/Registration: Friday, June 3

Power: Primary through Unlimited

Location: Salem-Leckrone (SLO): Salem, IL

Contest Director: Joe Overman

Phone: 314-452-6049

E-Mail: joeoverman2000@yahoo.com

Coalinga Western Open Championship (Southwest)

Friday, June 3 – Saturday, June 4, 2016

Practice/Registration: Thursday, June 2

Power: Primary through Unlimited

Location: New Coalinga (C80): Coalinga, CA

Contest Director: Tom Myers

Phone: 650-799-6854

E-Mail: tom.myers@stanfordalumni.org

Website: www.iac38.org

Bear Creek Bash (Mid-America)

Thursday, June 9 – Sunday, June 12, 2016

Practice/Registration: Thursday, June 9

Power: Primary through Unlimited

Location: Richard B. Russell Regional (RMG): Rome, GA

Contest Director: Mark Fullerton

Phone: 864 316 5250

E-Mail: markpccc2003@yahoo.com

Lone Star Aerobatic Championships (South Central)

Friday, June 10 – Saturday, June 11, 2016

Practice/Registration: Thursday, June 9

Power: Primary through Unlimited

Location: North Texas Regional Airport (GYI): Denison, TX

Region: South Central

Contest Director: J. J. Humphreys

Phone: 940-564-6673

E-Mail: jjhumpt1@brazosnet.com

Website: www.iac24.org

Wildwood Acroblast (Northeast)

Saturday, June 11 – Sunday, June 12, 2016

Practice/Registration: Friday, June 10

Power: Primary through Unlimited

Location: Cape May County Airport (WWD): Cape May, NJ

Region: Northeast

Contest Director: Tom Barrett

Phone: 202-679-6600

E-Mail: tbarrett@nert.com

Website: www.iac58.org

Ohio Aerobatic Open (Mid-America)

Friday, June 17 – Saturday, June 18, 2016

Practice/Registration: Thursday, June 16

Power: Primary through Unlimited

Location: Bellefontaine Regional Airport (KEDJ): Bellefontaine, OH

Contest Director: Samuel Weaver

Phone: 937-681-2680

E-Mail: piperj3cub46@gmail.com

Website: <http://www.iac34.eaachapter.org/>

Killam-Flagstaff Aerobatic Contest (International)

Saturday, June 18 – Saturday, June 18, 2016

Practice/Registration: Friday, June 17

Power: Primary through Unlimited

Location: Killam-Sedgwick/Flagstaff Regional (CEK6): Killam, Alberta, Canada

Contest Director: Randy Skiba

Phone: 403-504-7788

E-Mail: randallj@shaw.caWebsite: www.aerobaticscanada.org**Apple Cup (Northwest)**

Friday, June 24 – Saturday, June 25, 2016

Practice/Registration: Thursday, June 23

Location: Ephrata Municipal Airport (EPH): Ephrata, WA

Region: Northwest

Contest Director: Jerry Riedinger

Phone: 425-985-9469

E-Mail: jriedinger@perkinscoie.com**Midwest Aerobatic Championships 2016 (South Central)**

Saturday, June 25 – Sunday, June 26, 2016

Practice/Registration: Friday, June 24

Power: Primary through Unlimited

Location: Seward Municipal (KSWT): Seward, NE

Contest Director: Doug Roth

Phone: 402-432-7124

E-Mail: acrod@aol.comWebsite: <http://www.iac80.org>**HighPlanes HotPoxia Fest (South Central)**

Friday, July 8 – Sunday, July 10, 2016

Practice/Registration: Friday, July 8 – Saturday, July 9

Glider Categories: Sportsman through Unlimited

Power: Primary through Unlimited

Location: Fort Morgan (FMM): Fort Morgan, CO

Region: South Central

Contest Director: Dagmar Kress

Phone: 303-887-4473

E-Mail: dagmaraerobatics@me.comWebsite: <http://www.iac12.org>**Super D Tango (South Central)**

Saturday, July 9 – Saturday, July 9, 2016

Practice/Registration: Saturday, July 9

Power Categories: Sportsman

Location: Akroville (XA68): Denton, TX

Contest Director: Tom Rhodes

Phone: 214-202-7008

Michigan Aerobatic Open (Mid-America)

Saturday, July 9 – Sunday, July 10, 2016

Practice/Registration: Wednesday, July 8

Power: Primary through Unlimited

Location: Bay City James Clements Municipal Airport (3CM): Bay City, Michigan

Contest Director: Brian Roodvoets

Phone: 810-338-7654

E-Mail: redfoot@chartermi.netWebsite: iac88.eaachapter.org**The Corvallis Corkscrew (Northwest)**

Friday, July 15 – Saturday, July 16, 2016

Practice/Registration: Thursday, July 14

Power: Primary through Unlimited

Location: Corvallis Municipal Airport (CVO): Corvallis, Oregon

Contest Director: Jim Bourke

Phone: 541-231-6077

E-Mail: jtbourke@gmail.comWebsite: www.iac77.com/contests/corvallis-corkscrew/**Green Mountain Aerobatics Contest (GMAC) (Northeast)**

Friday, July 15 – Sunday, July 17, 2016

Practice/Registration: Monday, January 4 – Friday, July 15

Glider Categories: Sportsman through Unlimited

Power: Primary through Unlimited

Location: Hartness State Airport (Springfield) (VSF): Springfield, Vermont

Region: Northeast

Contest Director: Bill Gordon

Phone: 802-585-0366

E-Mail: wsgordon@earthlink.netWebsite: IAC35.aerobaticsworld.org**CanAm Aerobatic Challenge (Northwest)**

Friday, July 22 – Saturday, July 23, 2016

Practice/Registration: Thursday, July 21

Glider Categories: Sportsman through Unlimited

Power: Primary through Unlimited

Location: Cut Bank International (KCTB): CutBank, MT

Contest Director: Robert Harris

Phone: 503-550-1496

E-Mail: flyhran@aol.comWebsite: www.iac77.com**East Coast Open Championship (Southeast)**

Friday, August 12 – Saturday, August 13, 2016

Practice/Registration: Wednesday, August 10 – Thursday, August 11

Power: Primary through Unlimited

Location: Everett-Stewart Regional Airport (UCY): Union City, TN

Region: Southeast

Contest Director: Mike Rinker

Phone: 731-796-0849

E-Mail: mdr@vaughnelectric.comWebsite: www.iac27.org**Beaver State Regional Contest (Northwest)**

Friday, August 12 – Saturday, August 13, 2016

Practice/Registration: Wednesday, August 10 – Thursday, August 11

Glider Categories: Sportsman through Unlimited

Power: Primary through Unlimited

Location: Pendleton Regional Airport (PDT): Pendleton, OR

Region: Northwest

Contest Director: Sean VanHatten

Phone: 154-148-07456

E-Mail: seanvanhatten@gmail.comWebsite: www.iac77.com**ADVERTISERS' INDEX**

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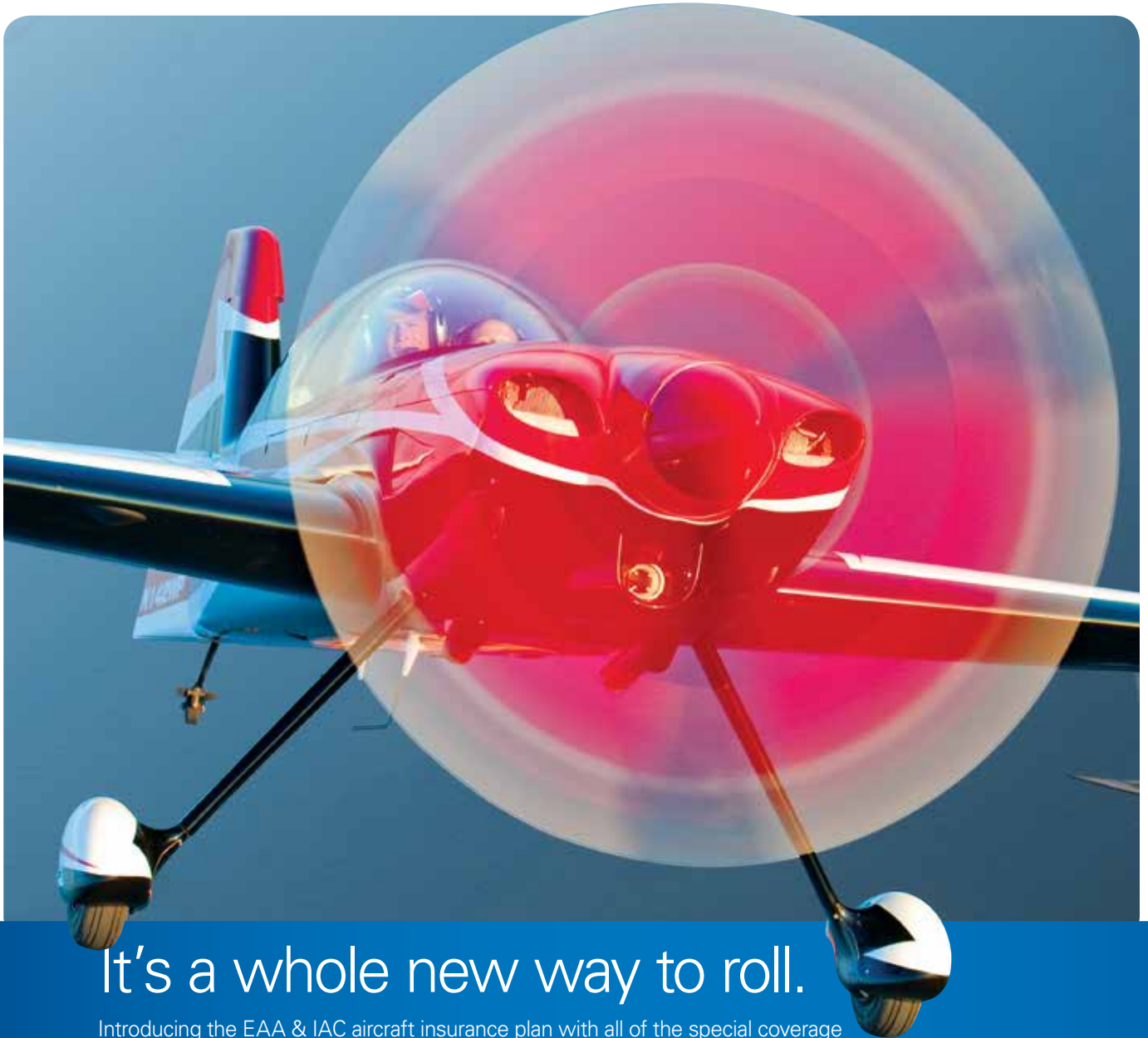
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