OCTOBER 2007

SPORT Aerobatics

OFFICIAL MAGAZINE OF THE INTERNATIONAL AEROBATIC CLUB

Firebolt N4GW: "This One is for George"

Also in this Issue:

- The ABCs of *G*'s
- No Inverted System? No Problem
- What is PWAC?

IAC MERCHANDISE

Men's and Ladies' Extreme E-Dry Golf Shirt

Stay cool and look fashionable in this Extreme E-Dry Polo Shirt. Featuring EDRY™ fabric which wicks moisture away from the skin. Subtle tone-on-tone logo on left chest. Available in Men's and Ladies' styles. **SM-XL $46.99 2XL $48.99**

Men's navy: SM I07752, MD I07753, LG I07754, XL I07755, 2XL I07756
Men's white: SM I07757, MD I07758, LG I07759, XL I07760, 2XL I07761
Ladies' navy: SM I07762, MD I07763, LG I07764, XL I07765, 2XL I07766
Ladies' frost blue: SM I07767, MD I07768, LG I07769, XL I07770, 2XL I07771

Men's and Ladies' Aerobatics USA Golf Shirts

Show off your national pride in these red, white and blue golf shirts. Men's feature three-button collar and ribbed sleeves. Ladies' shirts are cut especially to fit women and feature no-button collar.

Men's: **$45.99; $47.99 2XL**
White: SM I07772, MD I07773, LG I07774, XL I07775, 2X I07776
Navy: SM I05962, MD I05963, LG I05964, XL I05965, 2X I05966
Red: SM I05967, MD I05968, LG I05969, XL I05970, 2XL I05971
Women's: **$39.99; $43.99 2XL**
Navy: SM I05952, MD I05953, LG I05954, XL I05955, 2XL I05956
Red: SM I05957, MD I05958, LG I05959, XL I05960, 2XL I05961

Pitts Windshirt

This water repellant polyester microfiber windshirt with nylon lining is just perfect for keeping the chill away on those cold mornings and evenings. V-neck, elastic cuff and bottom band. Antiqued silver grommets under arms, front welt pockets with snaps. Pitts aircraft screen-printed on back. Aerobatics USA logo screen-printed on left chest. Available in gravel or red. **SM-2XL $39.99**

Red: SM I05937, LG I05939, XL I05940, 2XL I05941
Gravel: SM I05942, MD I05943, LG I05944, XL I05945

Eye-catching embroidered logo hats with adjustable straps.

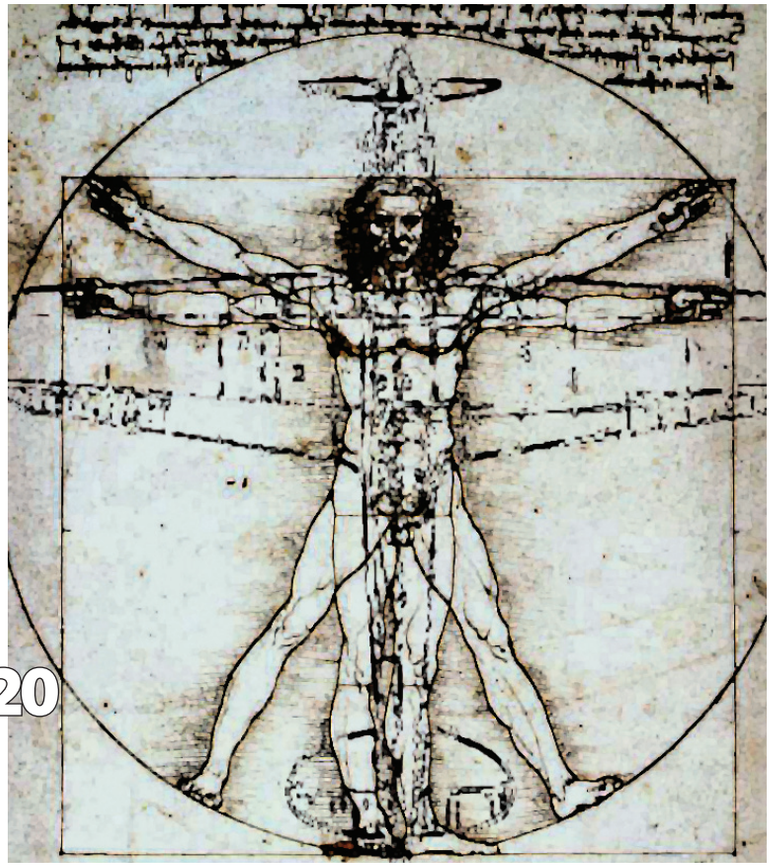
Tan with IAC logo: I07468 **$14.99**
Gray, White & Black with IAC logo: I09348 **$14.99**
White with Aerobatics USA logo: I07467 **$14.99**
Navy Aerobatics USA with Red White & Blue trim: I09347 **$14.99**

OCTOBER 2007 • VOLUME 36 • NUMBER 10 • IAC SPORT AEROBATICS

CONTENTS


8

14


20

FEATURES

COLUMNS

DEPARTMENTS

THE COVER

Chris May and his daughter, Sara, pilot their Wheeler Firebolt N4GW over Wisconsin during AirVenture 2007. Photo by Bonnie Kratz.

SPORT Aerobatics
OFFICIAL MAGAZINE OF THE INTERNATIONAL AEROBATIC CLUB

Publisher: Vicki Cruse
Executive Director: Lisa Popp
Editor: Scott Westover
Art Director: Phil Norton
Dir. of Publications: David Hipschman
Managing Editor: Kathleen Witman
Copy Editor: Colleen Walsh

Contributing Authors:
Reinaldo Beyer, Robert Bismuth, Vicki Cruse, Bruce Johnson, Greg Koontz, Chris May, Doug McConnel, Malcolm Pond, Allen Silver, Scott Westover

IAC Correspondence
International Aerobatic Club, P.O. Box 3086
Oshkosh, WI 54903-3086
Tel: 920.426.6574 • **Fax:** 920.426.6560
E-mail: *editorial@iac.org*

Advertising Director
Katrina Bradshaw **Tel:** 920.426.6836
E-mail: *kbradshaw@eaa.org*

Representatives:
Northeast: Allen Murray
Tel: 856.229.7180 **Fax:** 856.229.7258
E-mail: *allenmurray@mindspring.com*
Southeast: Chester Baumgartner
Tel: 727.532.4640 **Fax:** 727.532.4630
E-mail: *cbaum111@mindspring.com*
Central: Gary Worden
Tel: 800.444.9932 **Fax:** 816.741.6458
E-mail: *gary.worden@spc-mag.com*
Mountain & Pacific: John Gibson
Tel: 916.784.9593 **Fax:** 510.217.3796
E-mail: *johngibson@spc-mag.com*
Europe: Willi Tacke
Tel: 498969340213 **FAX:** 498969340214
E-mail: *willi@flying-pages.com*

Mailing: Change of address, lost or damaged magazines, back issues.
EAA-IAC Membership Services
Tel: 800.843.3612 **Fax:** 920.426.6761
E-mail: *membership@eaa.org*

The International Aerobatic Club is a division of the EAA.

WWW.IAC.ORG **WWW.EAA.ORG**

Judson Bartlett

LETTER from the EDITOR

by Scott Westover

This issue of *Sport Aerobatics* was a genuine joy to put together. Every month is a pleasure, but in many ways the monthly production schedule is like flying. As pilots we expect each flight to be fun, but nailing a perfect loop or greasing a crosswind landing makes some flights a little more satisfying than others. What I find satisfying about the October issue is that the content was directly shaped by IAC members through article suggestions, writing, and sharing personal stories.

When Jason Staloff sent me an e-mail suggesting that we address the art of flying aerobatics in aircraft without an inverted system, we set out to find an expert to share his knowledge. I'd like to thank Greg Koontz for sharing his humor and experience to answer some of Jason's questions while helping all of the aerobatic pilots who have different considerations than those with fully inverted systems.

At a time when there is a focus on improving the structural strength of aerobatic aircraft through the use of composite materials, two IAC members who are physicians put together an informative piece about the impact of *g*-forces on the weakest structural part in our airplanes — us! The work by Drs. Reinaldo Beyer and Malcolm Pond explains the human side of *g*-limitations and does so in a way that respects the intelligence of aerobatic pilots. I admit that some of the medical terminology and the math had me reaching for a dictionary and an abacus a couple of times — but in the end I learned more about the impact my flying has on my body than I ever learned in ground school. It actually helped me to understand what happened during a scary practice flight a couple of years ago, but that's a story for a different time.

In this issue we also catch a glimpse of the creativity of our members through an article authored by Robert Bismuth. Robert helped to launch the inaugural Primary World Aerobatic Championship held earlier this year. His crew is committed to keeping the fun in aerobatics. Perhaps the icing on the cake is the story shared by Chris May about his award-winning Firebolt. When I talked with Chris at AirVenture, I expected to hear about an outstanding airplane. What played back on the tape of our conversation was a story about a special friendship between two builders who brought out the very best in each other. Listening to Chris' story and working with all of our contributors is a privilege.

For the last several months you have read in this column that the editorial team believes this is your magazine. When we receive your story ideas, letters, and opinions we take them seriously and use them to build the strongest magazine possible. We intend to keep moving in that direction, and to be successful we will rely on you to keep in touch. I look forward to hearing from you — fly safely!

***Sport Aerobatics* is your magazine. To submit news, comments, articles, or article ideas, please send them to: IAC, P.O. Box 3086, Oshkosh, WI 54903-3086; or email them to *tookyflyer@tds.net*.**

PRESIDENT'S PAGE

by Vicki Cruse • IAC 22968
E-mail: vcruse@earthlink.net

As this is written, the U.S. Nationals is just less than one month away, and as you read this, it is about three weeks old. This year's U.S. Nationals will be important: here will be the selection of the U.S. Advanced Aerobatic Team that will compete in the Advanced World Aerobatic Championship (AWAC) next year. In 2008 the American team will not have to travel very far. The United States is fortunate to be hosting the event in Pendleton, Oregon, for the first time since 1997, when it was held in Lawrence, Kansas, and Gerry Molidor, Matt Morrissey, and John Morrissey brought home team gold.

The U.S. Nationals is also known as "Old Home Week" (no offense to the older, retired competition pilots). On a smaller scale, International Aerobatic Club (IAC) chapters have their own version of local "homecomings." Last weekend, California IAC Chapters 38 and 49 held critique sessions on Saturday (Chapter 38) and Sunday (Chapter 49) in preparation for an upcoming contest over Labor Day weekend and for those going on to the U.S. Nationals. With more than 100 members, Chapter 38 is probably the largest IAC chapter in the country, while Chapter 49 may be one of the smallest. Chapter 49 fell on hard times the last few years, but regular chapter meetings, interested people, and activities such as this one are reviving it.

Last year at the Borrego, California, contest, a spouse of one of the competitors said to me that she was astounded that people who are competing against each other help each other so much. I don't think this is unique to aerobatics, but to some it might seem a little unusual. Critique days are a perfect example. Chapter 38 had nine people attend its event, and Chapter 49 had eight, flying Primary through Unlimited. Chapter 38 President Darren Pleasance stopped by in his non-aerobatic plane with his son in tow to say hello and join in the fun. Sportsman pilots watched the Advanced pilots and learned how frustrating snap rolls can be. In turn, the Unlimited and Advanced pilots took their time to coach the Sportsman pilots on lines and loops, waxing nostalgic about the days when figures were much simpler.

"Generally, aerobatic pilots have a slightly warped sense of humor."

With a gathering such as this, food is a must and this is where the social outlet continues. Chapter 49's event was held in Delano, California, where a Mexican restaurant is adjacent to the airport. Since no one had a car, this was the restaurant of choice. Mealtime conversations can be interesting. Sometimes it's about the flights, weather conditions, or Internet happenings. Topics included YouTube videos "Triumph the Weather Dog" and "The Lonely Astronaut," written by a group called Twisted Mojo. Generally aerobatic pilots have a slightly warped sense of humor; perhaps this is why we get along so well, that and our drive for perfection.

Chapter 38 wasn't so fortunate, as there are no restaurants near the Tracy Airport in Tracy, California, and no one had a car. Some brought sandwiches and others looked on helplessly and hungrily. There were no reported moments of humor at this event, according to my source (perhaps it was my source with the humor problem). Then again, Chapter 38 is heavily laden with serious folks: business men, computer geeks, ex-Silicon Valley types, and one helicopter pilot who marvels at the lack of vibration in his Pitts. They, too, have a bond and a sense of purpose: fly their best and bring home trophies next weekend so those in Chapter 49 don't get one up on them.

At the end of the day, the empty airport in Delano and the quiet airport in Tracy go back to being empty and quiet. All traces of aerobatics vanish in all directions as the pilots fly home, no doubt thinking about how to improve their game for the next aerobatic flight and about what a great group of twisted people they hang out with.

NEWSBRIEFS

Munro & Associates drew crowds at AirVenture 2007 with their power train demonstrator.

Courtesy Munro & Associates

A rendering of the Personal Air Vehicle concept aircraft being developed by Munro & Associates.

Munro & Associates to Develop Flying Prototype of Paradigm Aircraft

Munro & Associates Inc. in Troy, Michigan, has announced the completion of the power train demonstrator for its Paradigm aircraft. With overwhelming positive response at EAA AirVenture Oshkosh 2007, the demonstrator clearly shows one solution to today's bankrupt transportation systems. By using efficient aircraft that operate point-to-point between small local airports, it has the potential to change the way most Americans travel. Munro has been in the business of innovation since 1988, and for the last five years has been focused on developing this unique transportation system.

According to a Munroe & Associates spokesperson, "The trick is bringing reliability and low cost to an industry that is short in both. To change this paradigm, Munro transfers technology from the automotive industry to deliver the same usefulness, reliability, quiet, comfort, safety, quality, cost, and functionality that we have come to expect from our automobiles."

Based on NASA's Personal Air Vehicle concept, the Paradigm will come complete with pilot automation that provides quantum leaps in aircraft operations, training, certification, and air safety. This full-scale technical demonstrator of the V-8-powered, ducted fan propulsion system is the final of several previously completed demonstrators for other elements of the airplane. Munro & Associates is ready to build flying prototypes and is currently looking for funding. For more information, please contact Joe Feord, director of sales and marketing, and former airline captain at 248-362-5110, ext. 206, or e-mail him at *JFeord@leandesign.com*. You may also contact Maverick Yamamoto (IAC # 20451) at 248-362-5110, ext. 320, or e-mail him at *MYamamoto@leandesign.com*.

William George "Bill" Hill Earns NAFI Master Instructor-Aerobatics

The National Association of Flight Instructors (NAFI) and the International Aerobatic Club (IAC) take pride in announcing a significant aviation accomplishment on the part of William G. Hill, a Sunrise Aviation flight instructor and a resident of Laguna Niguel, California. Recently, Bill was designated a NAFI Master Instructor-Aerobatics by NAFI and IAC.

To help put this achievement in its proper perspective, there are approximately 91,000 certificated flight instructors (CFIs) in the United States. Fewer than 600 of them have achieved that distinction thus far. The last 12 national Flight Instructors of the Year were Master Instructors, while Bill is one of only 43 California aviation educators to earn this prestigious "Master" title and one of only 13 nationwide to earn aerobatic accreditation. In the words of FAA Administrator Marion Blakey, "The flight instructor is where the rubber meets the runway. The Master Instructor accreditation singles out the best that the right seat has to offer."

NAFI

William G. Hill designated a NAFI Master Instructor-Aerobatics.

NAFI is dedicated to providing support and recognition for America's aviation educators while helping them raise and maintain their level of professionalism. It is also committed to providing a safe and effective learning environment for student pilots. Additional information is available at *www.NAFIMasters.org*.

Red Bull Air Race

Kirby Chambliss takes off from the deck of the USS Midway.

Chambliss Takeoff from Carrier

The USS Midway Museum, the longest-serving carrier in the U.S. Navy's history, was the platform for a stunning takeoff by Red Bull Air Race World Series race pilot Kirby Chambliss. The 2006 Red Bull Air Race champion performed his world-famous 90-degree "Cobra" takeoff from the deck of the Midway to announce the San Diego stop of the Red Bull Air Races, which were held in California last September. Now in its third year, the Red Bull Air Race World Series has 10 stops worldwide and will wrap up with a race in Perth, Australia, in October. *http://www.youtube.com/watch?v=KIEB2DY5ljQ*

STATEMENT OF OWNERSHIP, MANAGEMENT, AND CIRCULATION (Required by 39 U.S.C. 3685). 1. Title of Publication: Sport Aerobatics 2. Publication No.:0953-560. 3. Filing Date: 9/19/07. 4. Issue Frequency: Monthly. 5. No. of Issues Published Annually: 12. 6. Annual Subscription Price: $18.00 in U.S. 7. Known Office of Publication: 3000 Poberezny Road, Oshkosh, WI 54902-8900. Contact Person: Lisa Popp, Telephone: 920-426-6574. 8. Headquarters or General Business Office of the Publisher: Same as above. 9. Publisher: Vicki Cruse, 849 E. Harvard Blvd., #313, Santa Paula, CA 93060. Editor: Scott Westover, 310 Stumpfield Road, Hopkinton, NH 03229. Managing Editor: Kathleen L. Witman, 3000 Poberezny Road, Oshkosh, WI 54902. 10. Owner: International Aerobatic Club, 3000 Poberezny Road, Oshkosh, WI 54902-8900. 11. Known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amounts of bonds, mortgages or other securities: None. 12. Tax Status: Has Not Changed During Preceding 12 Months. 13. Publication Title: Sport Aerobatics. 14. Issue date for circulation data below: September 2007. 15. Extent and Nature of Circulation (Average No. Copies Each Issue During Preceding 12 Months/ No. Copies of Single Issue Published Nearest to Filing Date): a. Total No. of Copies Printed (5,143/5,034) b. Paid Circulation (By Mail and Outside the Mail): 1. Mailed Outside-County Paid Subscriptions Stated on PS Form 3541 (Include paid distribution above nominal rate, advertiser's proof copies, and exchange copies) (3,872/3,887). 2. Mailed In-County Paid Subscriptions Stated on PS Form 3541 (Include paid distribution above nominal rate, advertiser's proof copies, and exchange copies) (0/0). 3. Paid Distribution Outside the Mails Including Sales Through Dealers and Carriers, Street Vendors, Counter Sales, and Other Paid Distribution Outside USPS (503/485). 4. Paid Distribution by Other Classes of Mail Through the USPS (e.g., First-Class Mail) (50/51). c. Total Paid Distribution (Sum of 15b (1), (2), (3), and (4)) (4,424/4,423). d. Free or Nominal Rate Distribution (By Mail and Outside the Mail): 1. Free or Nominal Rate Outside-County Copies Included on PS Form 3541 (0/0). 2. Free or Nominal Rate In-County Copies Included on PS Form 3541 (0/0). 3. Free or Nominal Rate Copies Mailed at Other Classes Through the USPS (e.g. First-Class Mail) (51/50). 4. Free or Nominal Rate Distribution Outside the Mail (Carriers or other means) (440/420). e. Total Free or Nominal Rate Distribution (Sum of 15d (1), (2), (3), and (4) (491/470). f. Total Distribution (Sum of 15c and 15e) (4,915/4,893). g. Copies not Distributed (See Instructions to Publishers #4 (page #3))(228/141). h. Total (Sum of 15f and g) (5,143/5,034). i. Percent Paid (15c divided by 15f times 100) (90.01%/90.39%). 16. Publication of Statement Ownership: Publication required. Will be printed in the October 2007 issue of this publication. 17. I certify that all information furnished on this form is true and complete. I understand that anyone who furnishes false or misleading information on this form or who omits material or information requested on the form may be subject to criminal sanctions (including fines and imprisonment) and/or civil sanctions (including civil penalties). Executive Director: Lisa K. Popp, 9/19/07. PS Form 3526, September 2006

LETTERS to the EDITOR

Thinking outside the box about RV aerobatics

To the Editor:

I just received my August issue of *Sport Aerobatics* (We're in the middle of everywhere here in Saskatchewan and the post takes a while), and I was very interested in the article by Ron Rapp about "RV Aerobatics." The subtitle "an untapped market" really got my attention to see where he was going with the topic. I was intrigued with the interest his speaking engagement generated.

Learning of the sheer numbers of RV type aircraft out there got me really excited about the possibility of a whole new group of pilots and aircraft entering our sport. I was really disappointed when he wrote that he "didn't consider the RVs well suited for competition." This closes the door to the RVers. What are we recruiting them to? If IAC really wants to recruit the 5,000 RVers, then why not accommodate the aircraft? Make a new category suited to the type. Make their box bigger/higher and design sequences specifically for their type…a new Aresti – you can call it Gillespie and I'd be okay with that.

Big fast aerobatics is fun to watch and fly. I've had RV owners speak to me about their interest in learning some aerobatics in their aircraft. They just need a formalized process to go about it safely. The RVers would benefit from all the safety, experience, and help the IAC has to offer. We would see many RVers graduate and move into other aircraft, moving up through Sportsman/Intermediate and onwards. It could be a great farm team to recruit from. Around here competition aircraft are few and far between. I've been the only person in our province of one million people to be competing, and I have to fly far to do that. There are lots of RVs around here, and we could host a competition tomorrow and there would be a dozen aircraft available close by to participate. The RVs are sure better for traveling to competitions than my Pitts, and a lot of the RVs are family affair aircraft which could really add to our club.

IAC should approach the RV owners to see what the interest would be to form a new category. Is IAC interested in perusing this? I'd be happy to help make this happen.

Love to hear your comments.

Dave Gillespie
Saskatoon, Saskatchewan, Canada

To the Editor:

I just read the article from Ron Rapp in *Sport Aerobatics* August 2007. I agree completely that the RVs are wonderful airplanes and that especially the tandem-seaters are great aerobatic machines.

But, why not fly competitions with them? I have been flying my RV-4 since 1993 and have flown in many aerobatics competitions. On two occasions I reached first place in the Intermediate category at the German Aerobatic Championship (against competitors in CAPs, Zlins, and even Extras). Other pilots who also fly my RV-4 have reached very good results in the Sportsman category.

So my experience with the RV-4 is that one can fly this aircraft very well during competitions and stay in the box. The "secret" is simply to build a very light aircraft and make good use of the throttle, especially in the downlines. My personal limits with the RV-4 are +5/-3g, max speed 150 knots.

You can also fly maneuvers which are not part of the Sportsman category like snap rolls, inverted spins and rolling circles, and tail slides. All are easier to fly with the RV-4 than with the CAP 10.

I think that the RV-8 is not so good for competition because it is a much heavier aircraft (with the same wing as the RV-4); the side-by-side RVs are also heavier and they have smaller ailerons and therefore less roll rate.

Best Wishes,
Rudolf Hankers, IAC 0010378

Thank you for your comments, Dave and Rudolf. Letters like these in response to Ron's article have led to some interesting conversations at IAC. Our sport has always been evolving, so thinking outside of the box (no pun intended) is something we should all be doing when it comes to growing the aerobatic community.—SW

Join the Club!

Building an exciting sport aerobatics organization

Hillary Lawrence

Doug McConnell, IAC 862, Chairman,
IAC Membership Development

Aerobatics is simply thrilling! It is thrilling to watch and even more exciting to experience firsthand. Millions are entertained each year in happy crowds at air shows, and thousands are fulfilled each year as actual participating pilots and helpers. The excitement and fun of aerobatics has regularly drawn an impressive number of enthusiasts to the membership ranks of the International Aerobatic Club (IAC), and each month more join our busy international organization.

The organization began small back in 1970, but it began with lots of energy and with many experienced pilots, many of whom were active instructors and/or famous for their air show work. That is still true today, and many of today's experts contribute to the success of our U.S. teams and offer advice through the pages of *Sport Aerobatics*. Others who have joined include thousands of amateurs and novices who see sport aerobatics as fulfillment of a dream!

The sport has become much easier to enjoy since those early days due to availability of various certificated production aerobatic aircraft and active aerobatic flight instructors and schools. You no longer need to modify a Ryan or Chipmunk or Stearman to enjoy the sport. Now you can select from new and used factory-built models and many great homebuilt designs. With the abundant availability of Citabria, Decathlon, Extra, Edge, Pitts, and others, private owners and flight schools can now enjoy reliable machines with reasonable costs. This has greatly increased the availability of aerobatic instruction over the years!

The IAC, as an organization, grew from fewer than 1,000 in 1970 to more than 6,000 in the 1990s. It then shrank some following the downturn of active and new pilots entering into the aviation pool. Size matters, because membership dues help fund the excellence of our *Sport Aerobatics* magazine and support the IAC administrative office with all of its chores connected to an active membership. Chapters and fly-ins and conventions and contests don't just happen…they are planned and supported with thousands of hours of administrative assistance.

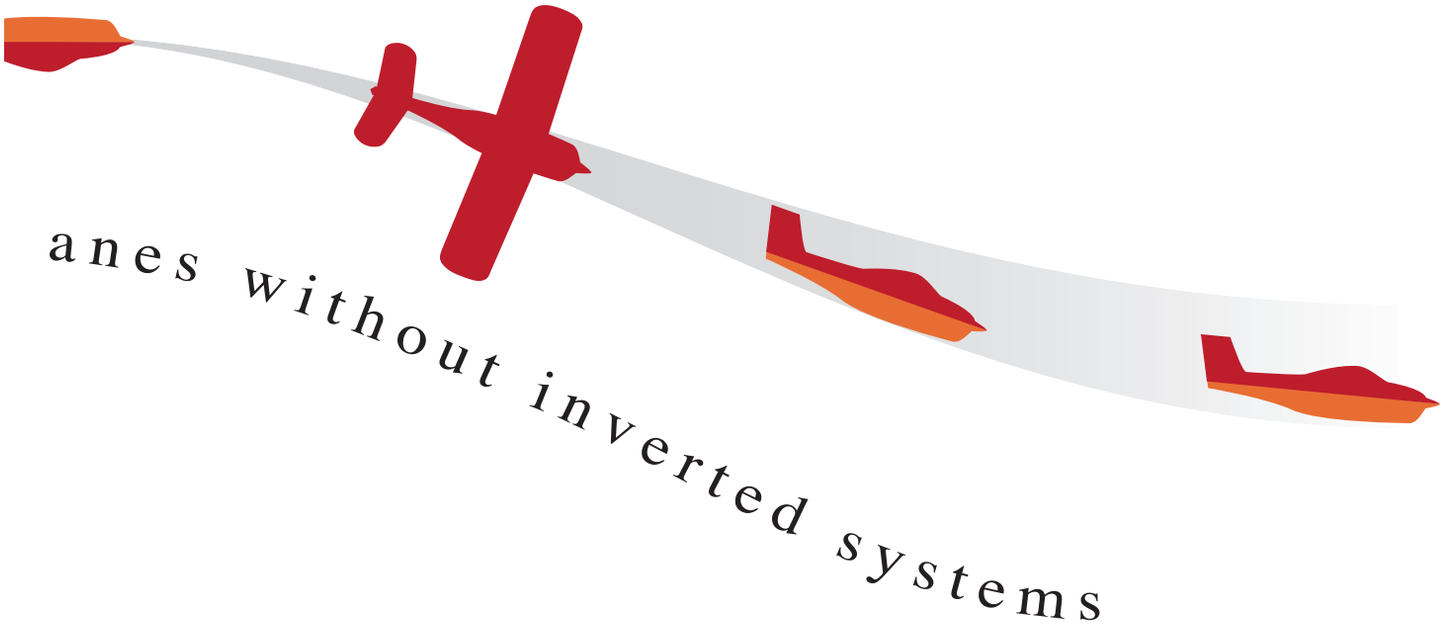
Cognizant of the need to grow and maintain an active and vital organization, the IAC board of directors has authorized tools to help IAC stay on the move! In 2007, members are seeing more attention being paid to the recruiting and retention of IAC members. To that end, many chapters launched local welcome campaigns for new members, using new posters and brochures created at IAC headquarters. The new brochures explain what IAC is and how to become involved. With the help of EAA marketing, direct mail will soon be sent to owners of aerobatic aircraft. Aerobatic flight schools, manufacturers, and sellers of aerobatic aircraft will be asked to offer an IAC membership to the aerobatic enthusiasts they encounter each month, and fly-ins will be canvassed with invitations to join our social and flying activities.

So, if you meet an enthusiast, whether pilot or not, be sure to step forward with your new "Booster Button Smile" and say, "Hey, why don't you JOIN THE CLUB?" They will be glad they did, you will be glad they did, and the IAC will gain needed momentum for the future!

Aerobatics in airpl

Courtesy Greg Koontz

Editor's Note: A few weeks ago I received an e-mail from Jason Staloff, IAC 433220, from Chapter 52. Jason explained that he was a newly minted private pilot and had become an IAC member as a student. His message went on to say, "Having just purchased a Citabria, I would be interested in finding some guidelines about training without an inverted system. It seems this might make a good article: There are plenty of affordable aerobatic-certified planes available, but specific guidelines are hard to come by…I'm worried because people sometimes adopt dangerous practices in the absence of clear advice, and it would be great to see this topic addressed head-on." Jason makes a good point, so I contacted one of the best grass-roots pilots I know and asked him to pen some advice. Greg Koontz was happy to oblige. Thanks for the idea, Jason!



Very Basic Flipping

Greg Koontz

The Good Old Days

In 1970 I entered my senior year of high school a changed person. On September 1, I had turned 17 years old, and I had passed my private pilot checkride early that morning. Life was good! As anyone who knew me then will verify, it was difficult to have a conversation with me that didn't eventually turn to aviation.

Having that brand new certificate riding in my wallet was very cool (well, in my mind anyway), but I soon felt like a cowboy without a horse. You can imagine what the 1040 bottom line looks like for a high school student. In a family of modest means I was having trouble renting an old Piper Colt every other week for 12 bucks an hour. Buying a plane seemed out of the question. But one day I was looking through a magazine and found a J-3 Cub pilot report by Budd Davisson. He made that airplane look great. Then, as fate would have it, I saw a classified ad in the local paper that same day selling a Cub project! Fourteen hundred dollars for a totally restored Cub with only one small hitch…it was not reassembled. I calculated my vast assets and factored in my steady Burger King income, took a loan from Mom, and soon had that truckload of parts in the basement.

After four months we actually turned that 3-D puzzle into a restored 1946 Piper J-3 Cub. There was no use in taking it to any shows for a ribbon, but to me it was the most beautiful thing I had ever seen. I was now a senior in high school who owned a plane, a cowboy with a stallion! Most boys in high school think only of football, cars, and girls, but I forgot them all (well, maybe two of them) for flying my Cub.

I was bit by the need to fly aerobatics at an early age, so obtaining anything that might loop made looping inevitable. Richard Millar, an old man that used to fly Cubs in the Civilian Pilot Training Program in WW II (he was 46), became my mentor as I explored the limits of the Cub. Let's be real here. The Cub is not really an aerobatic airplane. In its day it was certificated in the utility category, which allows spins and light aerobatics. I am now sure that "light aerobatics" means chandelles and lazy-eights, but you couldn't have told me that back then. Light to me meant it was restricted from outside loops and torque rolls! I soon set out to spin, loop, and roll in about that order.

Millar would give me advice, and then I would launch into the wild blue to try this stuff. Spins scared

With appropriate instruction, many classic aircraft provide a great platform for learning basic aerobatics.

me silly, but after a few dozen I learned that they would settle down into a really stable swirl. Loops were just a matter of pulling hard, letting up a little, and then pulling hard again. No sweat so far. But then came rolls.

To roll a Cub one must do a barrel roll or at least a roll involving a bit of a positive twist. After a few rather terrifying split-S maneuvers, I tried to push a bit to keep the nose up and soon found out the Marvel-Schebler carb does not supply fuel in negative flight. Who would have known! I mean, I couldn't even spell Marvel-Schebler!

Luck Is Not a Substitute for Knowledge

Looking back on those days I thank my creator for keeping my dumb butt in one piece. With some maturity I did learn there are lots of well-qualified aircraft for my aerobatic ambitions that are also quite affordable. The more-suited Reed clipped-wing Cub would have served me better. Citabrias, Stearmans, and a huge list of aerobatic homebuilts are out there waiting to do a loop and a roll. The ones I am referring to here share a common denominator; they have no system for running the engine inverted. What might be overlooked in our modern world of really advanced equipment is that these aircraft make fun and capable aerobatic mounts with the right amount of knowledge and understanding of their limitations.

If you're new to aerobatic flying, let me help a little here. The problem of making an engine run upside down is supplying fuel and oil. The run-of-the-mill carburetor works on a bowl and float valve that accumulates fuel and mixes it with the all-important air. This means they rely on gravity to accumulate that fuel. Now rather old and always expensive to repair PS-5 pressure carburetors have been adapted to our engines to bypass this problem. The nice people at Ellison came up with a more modern and simple slide-type carb, or throttle body, that creates a spray of fuel under a few pounds of pressure to eliminate the need for gravity to fill a bowl. This cures the running upside-down problem. So does fuel injection. The oil problem has been addressed in many ways over the years with methods of basically trapping some oil for a little help during brief periods of inverted flight. More than 30 years ago the Christen company came out with a neat system that picks up the inverted oil from the top of an engine and re-circulates it through the engine using the existing oil pump. This created reliable and continuous oil pressure and opened up a whole new generation of aerobatics.

The planes without these systems may seem outdated to some people, but I disagree. It would be great to see a special competition category created for this niche as these airplanes are lots of fun and a source for getting started in this great sport — so let's go fly.

First, be sure your aircraft was actually meant to do what you're about to attempt. Refer to the aircraft type data sheet to verify just what it was certificated to do. An experimental type certification requires a flight-test program and appropriate logbook endorsement for each aircraft intended for aerobatics. Then give it a thorough inspection. It takes almost 4*g*'s to do even basic aerobatics and maybe 6*g*'s to do not-so-basic recoveries, so investigate and be sure what you are flying is up to the task. Remember that it takes a healthy powerplant to endure some

of those large temperature changes and power adjustments. I have seen some of those tired old float-type carbs get their float stuck in the top of the bowl during an inadvertent venture into negative *g*. This will result in fuel starvation and a possibly challenging forced landing. Safety is good equipment.

Second, if you are just getting started, get a little dual from a *qualified* aerobatic instructor. If you are flying a single-seater, then rent something like a Citabria for the instruction. A little instruction goes a long way! Our non-inverted system plane is limited then to positive flight, which creates real problems performing Cuban-eights, Immelmans, and certain types of rolls. Level inverted flight is quite obviously not good, while normal spins and loops are relatively unaffected. It all boils down to positive or negative, or if you are creating your lift from positive angle-of-attack or negative angle-of-attack. Bottom line:

Tapping into the fun and excitement of basic aerobatics does not depend on an inverted system.

Courtesy John Mohr www.mohrbarnstorming.com

John Mohr and his stock Stearman prove that dazzling aerobatic displays depend on practice, not on inverted systems.

If you pull on the stick all is well; if you push on it your engine is going to stutter or momentarily quit. This limits our ventures into upside-down flight to a curved path called a parabolic arc.

An airplane will track through the air on a parabolic arc when it is creating no lift at all. This happens at the precise angle-of-attack that divides the relative wind into two parts that have equal distances to travel to the trailing edge of the wing. I call this the zero-lift angle-of-attack (AOA). You will know the stick position for this AOA because when you are creating no lift, you are also creating no *g*-force; therefore, you are weightless. This will still cause a stutter in most aircraft carbs, so you might be more comfortable with an AOA that is close to, but not exactly at, this AOA. A plane flying in a true parabolic arc will fly a straight path like a dart, uninterrupted by the forces of lift or aileron drag. A wing with equal airflow on both sides is in neutral lift and has two ailerons that, at that exact AOA, are creating equal amounts of drag. If you choose a slightly positive AOA (we're talking maybe one-tenth of a *g*) to keep your engine from sputtering, then expect a slight "corkscrew" flight path that requires a light amount of rudder to correct for aileron drag.

Now You're on a Roll

Rolls create the main challenge here. A roll has many definitions. We call it a slow roll when the flight path is in level flight, therefore creating the lift needed to maintain level flight all around the roll. This involves a constantly changing AOA to get the wing, and even the fuselage, to accommodate the lift requirements. An aileron roll, in contrast, is a roll that ignores the level flight requirement and simply flies the roll on a parabolic (no lift) arc. This eliminates the need to alter the AOA so the pilot simply sets the nose up to give an even arc across the horizon, pushes forward until a weightless feeling indicates the zero-lift AOA, and then applies full ailerons (while maintaining that forward pressure) to cause a roll while this arc is being flown. That's it! In this format no rudder is required since there is no aileron drag. If you choose to use rudders to increase your control, you could reduce the amount of nose-drop at the end by first adding a slight amount of top rudder at the last knife-edge position and then adding back-pressure at the last 45 degrees of roll. The top rudder will be tapered off during that last segment but not too fast. You will need to leave a little in for the aileron drag you will introduce when adding back-pressure. The old Cub just didn't have much rate of roll to do this, but an airplane designed to do some aerobatics will most probably have the required roll rate. The barrel roll, basically a loop/roll combo, should not create a problem for the non-inverted plane since AOA during this maneuver should approach, but not completely reach, zero lift. And for positive snap rolls, well, they're positive, so no problem.

A pseudo-inverted flight can be accomplished with a little finesse controlling AOA. Flying a long arc is possible with plenty of speed and careful stick placement. You can even keep a touch of positive *g* if necessary and still work out a four-point roll. Watch Mark Henley of the AeroShell Aerobatic Team do a solo act, and

you will surely see this in action. His T-6 has a carb that doesn't quit instantaneously after going inverted, and with a little skill he makes a long inverted pass down the show line hiding a slight curved flight path. If your airplane lacks 600 hp and 180 knot entry speed capability, you will need to be sure to have all the speed you can and plenty of up-pitch before rolling. John Mohr seems to defy all our theories with his stock Stearman. His low-level routine includes a roll on takeoff. Remember John was practically born in a Stearman and has developed his skills over a lifetime. And, if I'm not giving anything away here, his carb on that bird does continue running a little longer than most, giving him some help passing through inverted. John is an inspiration to all aerobatic pilots strapping into airplanes that do not have an inverted system.

Courtesy Greg Koontz

There are some maneuvers that demand help from an inverted system, including prolonged inverted flight.

Build a Strong Foundation

Obtaining and maintaining a zero-lift AOA (parabolic arc) is the fundamental skill necessary for this kind of aerobatic flight. After learning this skill with your instructor you will need to practice until finding the arc is second nature. You have no system to fly inverted, and a half-roll to *confusion* is not an option. It must be second nature to control the arc and to keep rolling until you are right-side up. To end up upside down, confused and out of ideas, will probably lead to a split-S maneuver at too high an entry speed. That's where the not-so-basic 6-plus *g* recovery might come into play. The moral of this story is don't ditch the instructor until you are at home in the roll environment.

Once you're proficient at rolls you will need to learn loops, hammerheads, and spins (if you haven't by now). These complete the four fundamental maneuvers of aerobatics and should be accomplished as a group to give you skills flying in most attitudes, situations, and recoveries needed to be safe. These additional maneuvers do not require an inverted system but will eventually be a part of a maneuver that will.

The next step requiring your zero-lift arc will be adding on Cuban-eights and Immelmans. The Cuban, as you probably know, is a loop that is stopped on the inverted 45 degree downline and, in the middle of a straight line of flight, is rolled to right-side up and followed by the same to create the shape of a sideways "8." In the non-inverted system plane we can mimic this maneuver by sacrificing the straight line for our arc. Depending on your rate of roll, you will need to begin your roll at or soon after reaching the top of the loop. Pause only for an instant then initiate your roll. As the plane rolls around to positive flight, first help the nose stay up on the line with a small amount of top rudder through knife-edge and then on the last 45 degrees of roll let that rudder input linger to correct for the aileron drag that is going to be introduced when you add back-pressure to keep the line. With a little (make that a lot of) practice, this rudder-then-back-pressure move will smooth out. At the end of the half-roll to right-side up, hold the line for a brief track and then repeat if you want a full Cuban-eight.

When the moves for the Cuban sink in, then go on to the Immelman. This maneuver is technically a perfect half-loop followed immediately by a perfect slow half-roll. For us non-inverted fliers this means going back to the arc for this transition. Once again it depends on the rate of roll you have. Make your loop a bit tighter than normal so you'll have some speed to work with at the top. Then, according to your rate of roll, start your roll out just a few degrees prior to the peak of the loop, making sure you are in zero *g* flight at the start of the roll. A little top rudder through the knife-edge portion will help followed by a little back-pressure starting at the last 45 degrees of roll. You don't have an inverted system so you are flying a curve. Some nose-down flying might well be necessary.

Smooth Flight

Hopefully by now you see that using the arc to replace inverted flight can be inserted into many maneuvers and will give you the opportunity to learn aerobatics in some alternative aerobatic aircraft. I use the same technique to give a passenger a nice ride even if I do have an inverted system. That hanging from the belts stuff is fine for those accustomed to it, but the non-pilot does not know the difference and will appreciate the smoother technique. Saving them from the discomfort of hanging on the belts will go well in making you the "smooth pilot" that gave them their first aerobatic ride.

As always, aerobatic flight requires a great vigilance on safety. Please have a good instructor/mentor and remember all the aspects of safety including a good parachute with a clear exit plan, the right airspace/altitude for aerobatic flight, and a reasonable engine failure plan. Be prepared. Then go out there and enjoy it!

Greg Koontz has held a flight instructor certificate since 1972. Of his 22,000 flight hours 7,000 have been as a flight instructor. He has flown most aerobatic types as well as 165 total types of aircraft. Greg spent 20 years as a corporate pilot and retired in 2002 to expand his aerobatic business into a full-time operation. He performs in about 16 air shows each year, and his major sponsor is American Champion Aircraft. Greg operates Sky Country Lodge as his home base and aerobatic flying school. You can learn more about his school at **www.GKAirShows.com** *or contact him at* **greg@gkairshows.com.**

This One is for George

by Scott Westover with Chris May

I wish I had met George Wheeler before he passed away. In some ways, after talking with Chris May at AirVenture, I feel as though I have. When Chris and I first began to chat I thought I was going to learn about the technical aspects of the Firebolt that Chris had flown to Oshkosh and tied down behind the IAC headquarters. It is a beautiful, head-turning airplane. Its lines are nostalgic, and the unique paint scheme makes it tastefully contemporary. It looks as though it's ready to leap into the air from where it sits with no runway necessary. However, after two minutes of conversation I realized that Chris was interested in talking about something bigger than the airplane—although he was obviously and rightfully proud of the biplane that was glistening in the morning sun next to us.

Most builders are eager to share the photo album that records the progress of the project—the journey from an inventory of tubes and sheet metal to a freshly painted airplane. Chris was more interested in sharing a single photograph lovingly placed on the wing. It was a photo of Chris and George shortly before George died of cancer, robbing him of the opportunity to complete the project that he had been working on for 14 years and for more than 7,000 hours with Chris and others.

That project is a Firebolt, N4GW. The Firebolt is the longer, wider, and

Bonnie Kratz

. . . Firebolt N4GW is a flying tribute to friendship

Courtesy Chris May

beefed-up version of the more familiar Skybolt. The plan specifications declare, "The cockpit seating design will accommodate a pilot and a passenger who weigh 230 pounds each and stand 6' 2" each with reasonable comfort." Today, N4GW belongs to Chris and is a tribute to a special friendship that began long before this beautiful airplane started to take shape. It was a friendship that began several airplanes ago, when Chris was a 19-year-old kid wrenching on a Mitchell Wing, which he describes as a "rigid wing with a 10-hp go-kart motor in it." As Chris neared completion of the airplane, he asked George Wheeler to take a look at the project. At that time Chris knew George through his reputation as an accomplished builder and his father knew George had helped several people in the area with their airplane projects. Chris admits that he was looking forward to showing off his first airplane. When George laid eyes on the Mitchell Wing, his comment to Chris was blunt. "You're not going to fly this thing, are you?" asked George.

That's the kind of comment that makes or breaks a friendship. Instead of being insulted, Chris decided to listen to what George had to say and to learn from someone who clearly had knowledge to share. Ultimately, the new friends decided to rework parts of the airplane, making the finished aircraft stronger and safer in the process. Along the way, Chris would begin to learn the skills he would need to complete the award-winning Firebolt he flies today. When the Mitchell project was complete, Chris made the mistake of discussing payment with George. George was insulted at the idea and refused to take money for his expertise, which was very much in line with his character. "Those that knew him well knew that George Wheeler was a giver," explains Chris. "If he were in a position to help anyone, he would." A B-25 pilot in World War II, George was one of six local boys to go off to the war and the only one to return. George knew he was lucky and dedicated his life to helping others when he returned to the States.

In 1991, George Wheeler started building the Firebolt that would

Heath Bartel

ultimately become N4GW. Around the same time, Chris began construction of an RV-4, under the close supervision of George, who viewed the RV as a great airplane through which to teach Chris the finer points of sheet metal work. George had a big goal for the Firebolt even as he rolled out the plans. He declared, "We're going to build this airplane and take it up to Oshkosh and see if we can't bring the big prize home." That dream was one that was big enough to survive even the man who dreamed it—with a little help from Chris and others who made the commitment to taxi the airplane over the finish line after George was gone.

Each man served as the other's extra hand during the building process, and in 1996 Chris flew his RV to the Sun 'n Fun Fly-In at Lakeland, Florida, where he won an award for best metal airplane. Clearly, George's influence was showing, and Chris' building skills were coming into their own. The Firebolt took shape more slowly. George labored over every detail and taught Chris to have the patience to get things right. The two had a standing agreement that nothing would be considered finished until George "put his stamp on it." Chris remembers working on both the RV and the Firebolt and having George examine a finished portion that Chris thought was ready for paint or covering, only to see the area differently from George's perspective and then reworking a detail or two before earning his mentor's "stamp."

The stamp changed hands in November of 2005 when George was diagnosed with cancer. As George underwent treatment, he talked with Chris about taking ownership of the Firebolt and finishing the project. Chris remembers George explaining the situation with the logic of a builder. "You've had your hands in this project more than anyone else," Chris recalls George as saying. "I know you'll finish it right and take care of the airplane when it is complete."

Despite his initial protests—partially out of financial concern and largely out of resistance to the reality of George's situation—Chris took ownership of the project in May of 2006. Despite declining health, George continued to work on the airplane with Chris as much as possible. A comfortable chair was placed in the workshop so that George could rest and continue to supervise the operation. Soon the sheet metal was in place. It was time to begin thinking about connecting the powerplant, which is a healthy 250-hp Lycoming IO-540.

True to form, George had the engine built for the Firebolt about eight years before he needed it. The engine had been pickled in oil for years. George mentioned to Chris that he would love to hear it run, but both men knew that starting it at this point in construction would cover the sheet metal with oil, potentially ruining any future paint plans. George was resigned to never having the opportunity to hear the powerful purr. Chris was not so willing to give up on the opportunity to bring a smile to George's face. He decided to remove the sheet metal and have an engine-starting party in George's honor. There was one catch. To be a genuine celebration, the moment that George heard the engine run had to be the first time it ever ran. There would be no test firing.

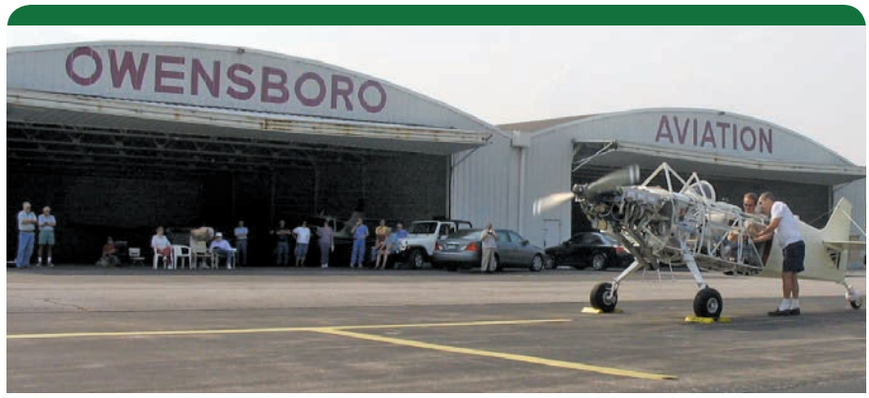
For three weeks George and Chris routed controls and configured fuel lines. Then, to minimize the chance of a failed start, Chris assembled three engine mechanics and supervised a long session of final adjustments. On the big day, George sat in front of the airplane surrounded by dozens of friends and family who had been involved with the project along the way. The starter was engaged, and in only four blades the Lycoming roared to life. Chris recalls, "George sat there in his chair with his arms folded. When the engine caught he grinned from ear to ear—it ran like a scalded dog."

After the successful start, Chris and George toasted the success and shared the afternoon with some friends. Six weeks later George was gone, but his friendship and teaching continued to guide Chris as he completed the project. Chris' goal was clear and remained unchanged from George's original vision: finish the airplane in time to wow the judges at Oshkosh.

It seemed that everywhere Chris turned in the final stages of the project, George had made arrangements to help him. George had made arrangements for the FAA certification, and his friend Bill Duke, a master machinist, was ready to machine the final parts. The finishing touch is

It seemed that everywhere Chris turned ... George had made arrangements to help him reach the finish line.

the one-of-a kind paint scheme that first draws attention to the airplane. This portion of the project is all Chris, who admits that George would probably have gone with a more traditional presentation. Chris was compelled to find something that was different from any other aircraft. After sharing the plans for the Firebolt with Greg Bruner, a local graphic designer and shooter of classic cars and street rods, a design began to take shape. The end result is the look that finishes N4GW today. Every piece of the airplane was painted separately and then assembled.



Courtesy Chris May

An engine starting party was held in George's honor.

As a final tribute to George, Chris decided to register the Firebolt as N4GW (for George Wheeler). The N number was registered to a glider that had been substantially damaged in 1981. Chris began some detective work, and with the help of California-based soaring organizations he was able to narrow the search for the aircraft. After dozens of phone calls, Chris dispatched his sister-in-law to inquire about some leads in her area, and remarkably, she found Denny Andrews, the owner of the damaged glider. Denny agreed to relinquish the N number and the FAA helped Chris transfer the N4GW registration just a week before the Firebolt was scheduled to make the trip to Wisconsin. Test flights and break-in were conducted using some temporary parts, and the final assembly took place on the Saturday before AirVenture. Twenty-four hours later Chris was en route to Oshkosh with his daughter Sara.

As our conversation wound down, I asked Chris to name his favorite part of the airplane. Predictably, he said, "The best part of the airplane is that it solidified my friendship with George." The final product of that friendship caught the eye of the judges, who recognized N4GW, the "Wheeler Firebolt," with a Bronze Lindy in the Plans Champion division. The prize is nice, but I have no doubt that it will hang well below the picture of a smiling Chris May and George Wheeler that I first saw on the wing of the Firebolt.

IAC MERCHANDISE

Men's Pocketed Golf Shirt

Two-color twill knit in 70% cotton/30% polyester. Knit collar and cuffs. Left chest pocket. Three button collar. Navy IAC logo embroidered on left chest.

SM-2XL $46.99

Men's Burgundy: SM I09430 MD I09431 LG I09432 XL I09433 2XL I09434
Men's Blue: SM I09435 MD I09436 LG I09437 XL I09438 2XL I09439

Men's Destination Links Dress Shirt

Super soft, super comfortable 60% pima cotton/40% micro polyester quick-dry fabric. Three button collar. Subtle tone-on-tone IAC logo on left chest. **SM-2XL $46.99** Men's Stone: SM I09440 MD I09441 LG I09442 XL I09443 2XL I09444

Pitts Special T

A classic comeback! You asked for it, you got it! This retro 1970s Pitts Special t-shirt features a "puffed" raised red ink to accentuate the Pitts model aircraft. Design on front of T. 100% cotton. **$15.99; $17.99 2X**

SM I07742, MD I07743, LG I07744, XL I07745, 2XL I07746

Unstraight and Unlevel T

Set your unique flying skills apart from the rest with this 100% cotton T. Large screen print on t-shirt back with smaller screen print on left front chest.

SM-XL $14.99 2XL $17.99

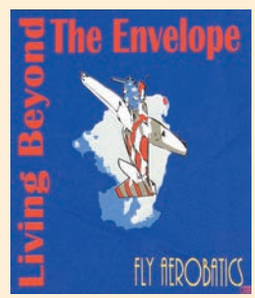
SM I09410 MD I09411 LG I09412 XL I09413 2XL I09414

Living Beyond the Envelope T

This stylish T features a patriotic aerobatic aircraft on a blue-sky background on the t-shirt back with IAC logo on left front chest.

SM-XL $14.99

SM I09415 MD I09416 LG I09417 XL I09418



Ladies' Moisture Management Advantage Dry Golf Shirt

Comfortable mesh knit in 70% cotton/30% polyester that wicks away moisture. No button collar with white shape-enhancing princess seams. Subtle tone on tone IAC logo on left chest. **SM-2XL $46.99**

Ladies' Isle/White: SM I09420 MD I09421 LG I09422 XL I09423 2XL I09424
Ladies' Canyon/White: SM I09425 MD I09426 LG I09427 XL I09428 2XL I09429

CALENDAR OF EVENTS

Rocky Mountain Invitational (South Central)
Saturday, October 20 - Sunday, October 21, 2007
Practice/Registration: Friday, October 19
Glider Categories: Sportsman through Unlimited
Power: Primary through Unlimited
Location: Lamar Municipal Airport (LAA): Lamar, Colorado
Phone: 303-648-0130, **E-Mail:** *jamietreat@hughes.net*
Director: Jamie Treat • **Website:** *www.IAC5.org*

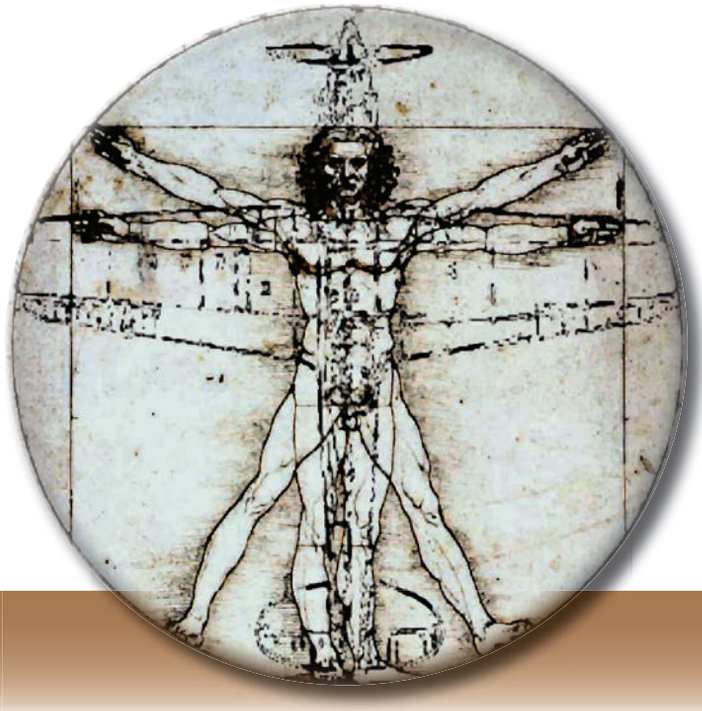
Mason-Dixon Clash (Northeast)
Friday, October 19 - Sunday, October 21, 2007
Power: Primary through Unlimited
Location: Farmville Regional Airport (FVX): Farmville, VA
Phone: 919-349-0057, **E-Mail:** *Jwslim1@aol.com*
Director: Jim Walker • **Website:** *www.IAC19.org*

Borrego Akrofest (Southwest)
Friday, October 19 - Saturday, October 20, 2007
Power: Primary through Unlimited
Location: Borrego Valley Airport (L08): Borrego Springs, CA
Phone: 714-743-0360, **E-Mail:** *ron@rapp.org*
Director: Ron Rapp • **Website:** *www.IAC36.org*

Sebring Aerobatic Championships (Southeast)
Thursday, November 8 - Saturday, November 10, 2007
Practice/Registration: Sat., Nov. 3 - Wed., November 7
Power: Primary through Unlimited
Location: Sebring Regional Airport (SEF): Sebring, Florida
Phone: 561-734-1955, **E-Mail:** *soaerobatics@aol.com*
Director: Mike Mays

Tequila Cup Regional Aerobatic Contest (Southwest)
Friday, November 9 - Saturday, November 10, 2007
Practice/Registration: Thursday, November 8
Glider: Sportsman through Unlimited
Power: Sportsman, Intermediate, Advanced, Unlimited
Location: Marana Regional Airport (AVQ): Marana (Tucson), AZ
Phone: 520-887-9399, **E-Mail:** *hollandsaac@comcast.net*
Director: Maryilnn Holland

As the 2007 contest season winds down, please let us know when you confirm the dates for your 2008 chapter contests! Visit www.IAC.org and submit your contest information.



The ABCs of G's

A MEDICAL PRIMER for AEROBATIC PILOTS

Reinaldo Beyer, M.D., & Malcolm Pond, M.D.

During aerobatics, your body is constantly being whipped about by large *g*-forces. Strictly defined, you are actually experiencing accelerations rather than forces. Accelerations occur in the transverse, lateral, and vertical axis using the body of the pilot as a reference. Figure 1 illustrates this coordinate system. We will limit this article to a discussion of forces illustrated by the gz arrows that pass through the "top" and "bottom" of the aircraft and pilot.

HOW MANY *GZ*?

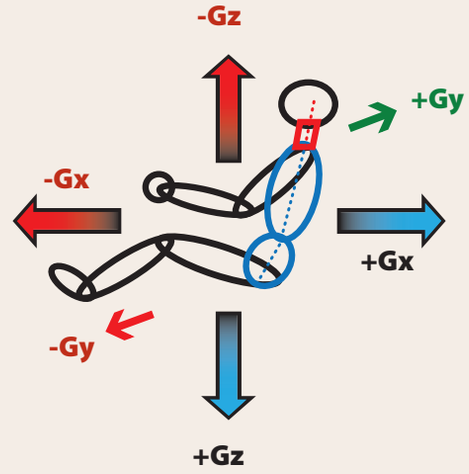
In order to change the flight path of an airplane a force is generated, which accelerates the plane from its existing flight path to a new one. This acceleration (a) is proportional to the square of your velocity (v) and inversely proportional to the radius (r) of the curved flight path. This relationship is illustrated in the formula: a = v2/r.

Why is this important to you? Let's say that you want to fly a loop at 160 knots with a diameter of 800 feet. Using the above formula, the calculated *gz* is 5.67. Here's how we got there:

gz = {[(160x6080)/3600]2/400}/32.17 where 1 knot = 6,080 feet/hour, 1 hour = 3,600 seconds, 1*g* = 32.17 feet/second^2, and r = 800/2.

The important information revealed in our equation is that the *gz* for this plain vanilla loop approaches the *g* limits of a Decathlon or Pitts. Every item on your aircraft momentarily weighs almost six times more than it did on the tarmac. The estimated 1,600-pound gross weight of your airplane is now 9,072 pounds. The standard 170-pound FAA pilot tips the scales at 964 pounds. While these increases in weight may be addressed through stronger construction and horsepower, there are other factors to consider.

Fig. 1: *G*-accelerations acting on the pilot



PHYSIOLOGIC EFFECTS OF +*GZ* AND -*GZ*

The human body has developed circulatory mechanisms to compensate for changes in posture (for instance, when standing up from a reclining position), but it is not accustomed to the drastic changes in *gz* typical of an aerobatic flight. In order to compensate for changes in *gz*, we use both voluntary and involuntary mechanisms. Constriction of arteries in the lower extremities and changes in heart rate are involuntary mechanisms. Voluntary maneuvers include anti-*g* suits and positive pressure breathing devices that can further increase our tolerance to *gz*.

As your heart contracts it generates pressure, usually in the range of 120 mm Hg (millimeters of mercury or torr), sufficient to create blood flow to your brain and other organs. The brain and eye need this steady inflow of oxygen-carrying blood in order to keep their function; they are exquisitely sensitive to a lack of oxygen. The oxygen reserve allows for only five seconds of function without blood inflow. Now consider that your cerebral cortex is approximately 18 inches above the level of the heart. An 18-inch column of blood is equivalent in pressure to 33 mm Hg. This means that the blood pressure at the cerebral cortex is 33 mm Hg less than the pressure that exits at the level of the heart, resulting in approximately 87 mm Hg. If this 18-inch column of blood is subjected to 2.6 *gz* (87/33 = 2.6), there will be no flow to the brain unless there is some sort of involuntary or voluntary compensation. All competition sequences (even primary) have periods where *gz* exceeds +2.6*g*.

WHAT KEEPS PILOTS FROM LOSING CONSCIOUSNESS?

When there is a dramatic stimulus such as a pronounced fall in blood pressure, the brain activates the sympathetic nervous system. Catecholamines are released, causing the heart to speed up and the arteries in the arms and legs to constrict. Blood flow is diverted away from the liver, spleen, and abdominal organs. These mechanisms take a minute or more to kick in and help to explain our primordial ability to fight with or run away from a saber-toothed tiger. The carotid arteries in the neck have pressure sensors (called "baroreceptors") that help the body regulate blood pressure and heart rate on a moment-to-moment basis. These are the involuntary mechanisms that help the blood pressure and flow to the brain remain stable during periods of *gz* stress.

Gravity pulls blood out of organs and vessels above the level of the heart and pools it into organs below the heart. Pressure in ankle veins has been measured at 400 mm Hg at +8*gz*. This pooling diminishes the return of blood to the heart and results in less blood pumped with each heartbeat. Unless the heart rate increases, the cardiac output decreases.

Negative *gz* redistributes blood to the upper body. The physiologic responses are essentially opposite to the response to +*gz*. Heart rate slows and the baroreceptors cause leg and arm arteries to dilate in an attempt to lower blood pressure. Intracranial pressure can increase dramatically during prolonged high -*gz*, since the volume of veins and arteries increases inside the rigid compartment of the head. At extreme loads fluid leaks into the brain. The more delicate blood vessels in the eyelids, eyes, and face can break from the higher hydrostatic pressure.

HELP YOUR BODY HELP ITSELF: ANTI-*G* STRAINING MANEUVERS

When pulling +*gz*, we can assist our cardiovascular system by preventing the shift of blood from the upper body to the lower body. There are large veins in the pelvis, abdomen, and legs, which together with abdominal organs like the liver and spleen act as reservoirs of blood. One can squeeze these veins and reservoirs by compressing them. Contraction of your leg muscles and your abdominal muscles will shift blood to the upper body, as you can tell while watching a piano mover's face engorge and turn red when trying to lift a piano. See Table I for the straining maneuvers. Note that all maneuvers are similar, differing in whether or not air is being exhaled during the chest contraction, and whether there is muscular contraction of the arms and legs. Be aware that the plain Valsalva maneuver (forced chest contraction without exhaling) can decrease the +*gz* tolerance if started too late or done for too long.

Table I: Anti-*g* Straining Techniques

	DESCRIPTION	NOTES
M-1	Neck muscle contraction: Pull head down between the shoulders. Grunt: Slowly and forcefully exhale through a partially closed glottis. Simultaneously tense abdominal, arm, and leg muscles. For long duration exposure repeat every 5 seconds after inhaling a very fast gasp of air and then immediately restarting the contraction.	Effective. Strenuous. Laryngeal irritation when repeated, hoarseness after flight. Increases tolerance by +2gz.
L-1	Neck muscle contraction: Pull head down between the shoulders. Forcefully exhale against a completely closed glottis (no grunt). Simultaneously tense abdominal, arm, and leg muscles. For long duration exposure repeat after exhaling and inhaling.	No post-flight hoarseness. If repeated the pause for inhalation/exhalation is longer, during which there is no protection. May be as effective as M-1.
M-2 (Valsalva)	Forcefully exhale against a completely closed glottis (no grunt). Abdominal muscles will tense. No voluntary tensing of arm or leg muscles	Less effective. May cause G-LOC if not started well before the onset of +gz. Should not be repeated.

Muscular contraction helps the heart to maintain its output by preventing pooling of blood in the lower body. By tensing your chest and abdomen, you are assisting your heart momentarily to generate just a little more pressure, sufficient enough to overcome the 2.6 +*gz* at

which blood flow to the brain ceases. When there is no flow to the brain, and your 5-second reserve has elapsed, all of the involuntary and voluntary compensations for excess +*gz* have been exhausted, and your central nervous system shuts down.

G-LOC AND OTHER EFFECTS OF *GZ*

If the limits of compensation are reached, loss of function and even injuries can occur. Pilots frequently refer to temporary loss of brain function as "blackout," but in fact we can be more precise about the types of temporary neurological effects. Look at Table II:

Table II: +*Gz* Induced Neurological Effects

G-induced loss of consciousness or *G*-LOC.	"Passing" out, myoclonic jerks, confusion, loss of memory.
Temporary blindness without loss of consciousness.	"Blackout."
Loss of peripheral vision, tunnel vision.	"Gray-out."
Loss of hearing.	Temporary deafness.
Psychomotor performance degradation.	Poor hand-eye coordination, brief dreams.
	Transient paralysis, inability to speak and reason.

We refer to "gray-out" and "blackout" strictly as visual symptoms, without loss of consciousness. Each eye functions as a rigid spherical compartment that is perforated by blood vessels in the back of this sphere. The retinal artery delivers oxygenated blood to the eye, and retinal veins exit from it. The internal pressure of the eye compartment is slightly higher than the brain inside the skull. As blood pressure diminishes from sustained +*gz*, flow to the retina ceases shortly before flow to the cerebral cortex, since compression of the retinal vessels from the internal eye pressure occurs before compression of the cerebral vessels. The result is loss of peripheral vision first, then complete loss of vision, and finally loss of consciousness. Gray-out occurs when the retinal artery pressure is about 50 mm Hg, and blackout occurs when the pressure is 20 mm Hg.

Other neurological effects of high +*gz* include temporary loss of hearing and deterioration of motor skills and hand-eye coordination before unconsciousness. In the most extreme situation, blood flow to the brain ceases and unconsciousness ensues. This is "*G*-LOC," or *gz*-induced loss of consciousness, a phenomenon that has been well-known to aviators since World War I. During *G*-LOC the pilot is completely incapacitated, loses motor control, then goes through a period of relative incapacitation until he recovers from the episode. After an episode of high +*gz*, absolute incapacitation usually lasts 12 seconds (even if the pull is immediately released), and relative confusion and disorientation last usually from 15 to 90 seconds or more. Thirty seconds to a minute or more elapses before the pilot is able to regain control of the aircraft. Uncontrolled muscle jerking or "myoclonic jerks" occur during *G*-LOC.

High +*gz* has resulted in other types of skeletal and internal organ injuries. Most of these injuries are very rare. Often the pilot has some underlying medical condition that is not recognized prior to the injury. These injuries can include tearing of abdominal arteries, partial collapse of the lungs, herniation of the diaphragm, cervical spine injuries, and heart attack.

THAT'S THE POSITIVE SIDE. WHAT ABOUT THE NEGATIVE?

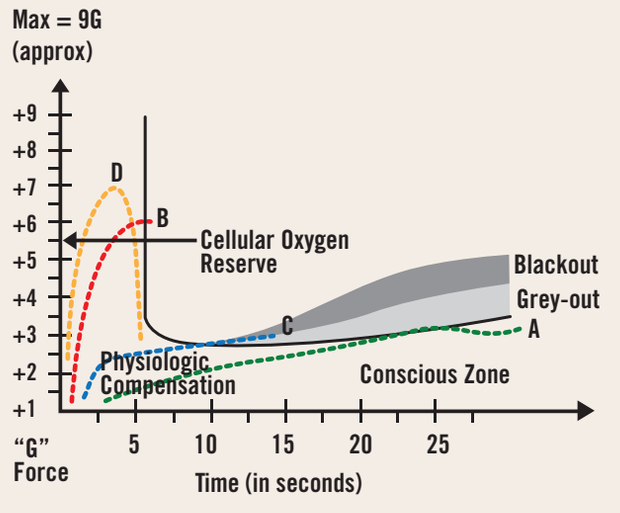
Negative *gz* has its own set of unique problems. Headaches are very common after -*gz* exposure. Conjunctival and eyelid hemorrhages are also frequent, particularly in the initial training stages. As mentioned before, intracranial pressure can increase during prolonged high -*gz* and fluid can leak into the brain.

One troublesome effect related in part to high -*gz* is spatial disorientation or vertigo, commonly known as "the wobblies." It has occurred in more than 10 percent of Unlimited category pilots and can be persistent and disabling, or it can be less intense and recurrent. It is triggered by abnormalities of the vestibular canals in the inner ear when otoliths (small particles responsible for our sense of up and down) are dislodged into an abnormal position. Rest, medications, and specific types of head positioning maneuvers known as Eppley maneuvers can help vestibular function return to normal. Little is known about other types of injuries from -*gz*, since most research has been performed on military pilots, who are not routinely subjected to high -*gz*.

LET'S GO FLY!

Now let's strap into the cockpit and pull some *g*'s. Consider several different scenarios that we might encounter while flying our aerobatic routines. Figure 2 shows a graph of +*gz* plotted against time.

Fig. 2: G tolerance, shown as *gz* versus time



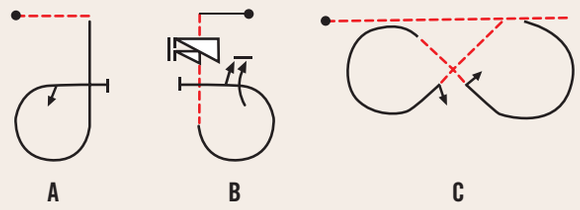
This graph illustrates the time to onset of gray-out/blackout and *G*-LOC at different +*gz*. Look at the first scenario, depicted as "A." Here the pilot is gradually

increasing +*gz* until visual clues warn of impending *G*-LOC. At gray-out he releases the +*gz* and vision returns quickly, within two seconds. Hunting for the *G*-LOC threshold is similar to a game of Russian roulette, and exposes the pilot to the risks of *G*-LOC longer than another strategy, shown as "D."

In "D" the pilot does a brisk pull to +7*gz* (assuming that he stays within the performance envelope of the aircraft) and quickly backs off. Total time to high +*gz* exposure is 5 seconds or less, so there is no threat of *G*-LOC. Remember that there are only 5 seconds of useful consciousness in the absence of blood flow to the brain. Of course, our pilot must be aware of other hazards such as internal injuries, especially neck injuries.

But what if the pilot miscalculates and maintains +*gz* for just a few seconds more? See scenario "B." Let's say that he or she is flying a 3/4 loop down after an inverted entry (Aresti diagram A in Figure 3) and is low on altitude and high on speed.

Figure 3: Figures that might induce *G*-LOC



Here our hapless pilot is subjected to sustained high +*gz* for more than five seconds. Loss of consciousness will probably occur two-thirds of the way around the loop unless he starts anti-*g* straining maneuvers immediately. The pilot will not have any forewarning visual symptoms, and will not wake up for about 30 seconds (even if +*gz* are immediately released), after which psychomotor difficulties may last for another several minutes. After regaining consciousness, the pilot might have total amnesia of the event, feel nauseated, and even vomit. *G*-LOC is clearly a recipe for disaster.

The only way to prevent this is by being aware of the problem in advance and starting anti-*g* compensation before the pull for the loop. If you are in a situation where *G*-LOC might occur and you start to gray out, release the +*gz* immediately. Don't worry about the judges' scores; your life is more important!

The last scenario in Figure 2 is "C." Here moderate but sustained *g*-loading can induce *G*-LOC within 10 seconds or less. This might occur when you are in a sustained 3*g* spiral dive at the end of your routine while losing altitude and coming back to the airport. You are just as much at risk for *G*-LOC as you would be during the shorter high +*gz* maneuvers during your aerobatic sequence.

THE PUSH-PULL PHENOMENON

Positive *gz* loading after a period of inverted flight or push maneuvers deserves special attention. Tolerance

to +*gz* is greatly reduced if it is preceded by -*gz*, or even 0 *gz*. This is known as the "push-pull phenomenon." With -*gz*, the heart rate slows and vessels dilate in response to the baroreceptors in the neck. If a negative or zero-*g* maneuver is followed by immediate exposure to +*gz*, the body is not able to compensate by the involuntary mechanisms discussed earlier. *Gz* tolerance can be instantaneously reduced by as much as 40 percent.

Figure 2 shows several maneuvers in which the "push-pull" phenomenon could play a role and induce *G*-LOC. Note that Figure 2b does not have a push or sustained inverted flight; however, the vertical line and spin expose the pilot to less than +1*gz*. Note also that the maneuvers depicted in both figures 2b and 2c are perfectly legal in an intermediate unknown. *G*-LOC is not just a problem confined to Advanced and Unlimited pilot categories.

GZ TOLERANCE

G tolerance is measured by the total time and amount of +*gz* that a pilot can withstand and still perform simulated air combat maneuvers. The lessons learned from studies done 50 years ago by the U.S. Navy still apply today to military and recreational aerobatic pilots. The following are some factors that affect *gz* tolerance.

Fitness: Weight lifting and isometric exercise seem to increase *gz* tolerance. Low body fat, low muscle mass, and aerobic cardiovascular conditioning such as running might actually decrease *gz* tolerance. However, aerobic fitness improves your ability to perform anti-*g* straining maneuvers. Chest and abdominal muscles in particular are important for the performance of the anti-*g* straining maneuvers. Strengthening of the muscles of the axial skeleton, especially the neck, helps to prevent injuries. Neck injuries are extremely common in fighter pilots, and have occurred in more than 90 percent of them during their flight careers.

Individual variations: Taller pilots are more sensitive to the ill effects of *gz*, due to the increased distance from the head to the heart. Women and men have the same ability to withstand *g* duration and *g*-load, when allowances are made for differences in body muscle mass. High systolic and diastolic pressures, older age, and higher resting heart rate improve *g* tolerance.

Food, caffeine, alcohol: Hypoglycemia decreases *gz* tolerance. A high-fat-heavy meal diverts blood flow from the peripheral muscles to the intestine and decreases tolerance. Alcohol can have a profoundly deleterious effect. With a blood alcohol level of 0.1 percent (legally drunk), tolerance to 2*gz* is reduced by 40 percent, and tolerance to 5*gz* is reduced 90 percent. Even 12 hours after drinking alcohol (longer than the FAA-mandated eight-hour bottle to throttle), a pilot's *gz* tolerance is reduced as a result of hangover and mild dehydration. In spite of its stimulant effect, caffeine is a mild diuretic and also creates a dehydrated state. Coffee, tea, or soda before the flight could potentially hurt your *gz* tolerance!

Hydration and electrolytes: For years, studies of competitive athletes have demonstrated that even minor levels of dehydration significantly decrease athletic performance. Our bodies are mostly water. Sixty percent of the lean body weight of men is water. (The percentage is somewhat lower in women.) In addition to water, we need sodium, potassium, and other electrolytes for our cells and tissues to function properly. The composition and concentration of this electrolyte solution is crucial, and is tightly regulated. Minimal changes in electrolyte concentrations hinder the normal functioning of cells. Proper hydration facilitates the correct balance of water and electrolytes.

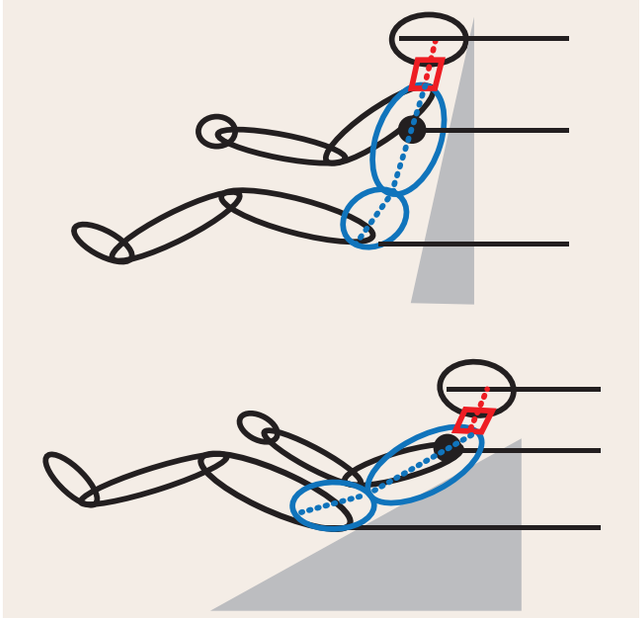
To maintain fluid and electrolyte balance, we must compensate for what we are losing. In practical terms, we lose fluids in two ways:

1. Obligatory losses derived from metabolic activity, including loss of water vapor through respiration, skin evaporation, and urinary excretion. Fluids lost in these ways consist mostly of pure water. Low humidity increases the obligatory evaporative loss through the skin and lungs. About 500 milliliters per day of urine is necessary to excrete metabolic byproducts, including a very small amount of sodium. Obligatory water loss is replaced by water alone.

2. Perspiration, which is related to the ambient temperature and to the level of exercise. Perspiration is a hypotonic or dilute salt solution, but not pure water. The amount of sodium and potassium in it varies depending on your level of fitness. Fluid and electrolyte losses are not trivial. A normal person can produce up to 2 liters per hour of perspiration.

Minimal drops in the body concentration of electrolytes have profoundly negative effects on the ability to maintain blood pressure control, muscular strength, and mental

Figure 4: Changes of seat angle



performance. Dehydration by as little as 3 percent (which in most people is not noticed) reduces *g* tolerance over 40 percent. Replacement of obligatory losses with water alone creates the risk of "water intoxication" and dilution of electrolyte concentrations. Water intoxication is a potentially fatal risk to marathon runners and endurance athletes. Even slight decreases in electrolyte concentrations in the body can cause low blood pressure and cardiovascular collapse. Other than meals and water, sports drinks with balanced amounts of glucose, water, sodium, and potassium are probably the best way to replace fluid and electrolyte losses. Their key advantage is fast absorption: Sodium and electrolytes are available to your system within 30 minutes. Solid food takes longer to absorb.

Training: Repeated exposure to +*gz* at progressively higher levels improves tolerance. Anti-*g* straining maneuvers are more effective in the trained pilot. The effect of training develops in little over a week with a daily regimen, but is also quickly lost if exposure to *gz* is stopped. One cannot downplay the importance of practicing anti-*g* straining maneuvers. The maneuvers only work when done correctly.

Medications: Some medications that act on the cardiovascular system may reduce +*gz* tolerance. These include diuretics and various medications for hypertension.

Illnesses: Common illnesses such as flu, the common cold, and particularly gastrointestinal problems reduce tolerance. Mild hypertension paradoxically increases tolerance. High *gz* causes shunting of blood within the lungs. The lower portions of the lungs become congested and the upper parts of the lungs experience reduced blood flow. This causes a drop in blood oxygen concentration. Smoking and respiratory illnesses only make matters worse. Sinus congestion or head colds can cause intense pain and hearing loss due to rapid altitude changes while performing aerobatics.

Seat angle: Tolerance to *gz* is higher when the pilot is in a more reclined position. The vertical distance from the heart to the eye and brain decreases. Moreover, the distance from the heart to the pelvis and the lower body blood reservoir is less. In order to be effective, the angle of the seat back has to be at least 30 degrees from the direction of the *gz* vector. Greater effects are obtained with angles of about 55 degrees or more; however, this creates a higher chance of neck injuries because the neck is flexed more. The neck is most resistant to *gz* in the normal upright position facing forward, without any flexion, extension, inclination, or rotation. See Figure 4.

Anti-g suits and positive pressure breathing devices: They act in a similar way to the anti-*g* training maneuvers, but greatly reduce the problem of pilot fatigue. They are cumbersome, have lag time, and can interfere with flight controls. The Blue Angels don't use them specifically because of this.

Aerobatics is a physically demanding pursuit that challenges the pilot in many ways. Understanding *g*'s, their physiologic effects, ways to cope with them, and our own individual limitations are part of the most fundamental skills of the accomplished aerobatic pilot.

Courtesy Reinaldo Beyer and Malcom Pond

Doctors Malcolm Pond (top) and Reinaldo Beyer lend their clinical insight to the g-phenomena experienced by all aerobatic pilots.

PWAC: THE PRIMARY WORLD AEROBATIC CHAMPIONSHIP

Story by Robert Bismuth, photos courtesy of Ivan the Uncompromising

The inaugural PWAC was dominated by Sam Roland of Victoria, British Columbia, who scored an impressive 82.76 percent.

The idea for the "Primary World Aerobatic Championship" (PWAC) started a few years ago when I flew from Seattle to the U.S. National Championships simply to compete in the Primary category. The other pilots there from the Northwest were all competing in the Advanced and Unlimited categories. At the time, team selection was happening for the 2006 AWAC. Naturally I was ribbed a lot about being there for the "PWAC selection."

As I flew back from the Nationals I had plenty of time to think about the majority of aerobatic pilots—the ones who are not yet up to the bone-bending flying extremes of the Advanced or Unlimited categories. In fact, from what I'd seen, there are a lot of pilots who enjoy aerobatics at the opposite end of the aerobatic competition envelope and are completely content to keep flying at their current level. However, they are definitely no less competitive than any pilot in the "higher" categories, so why not structure a championship event for them?

Thus, PWAC was born. In June of this year, after 18 months of planning, the first PWAC was held in Ephrata, Washington, immediately after the annual Apple Cup Regional Competition.

The lead-up to PWAC involved many considerations—insurance, the box waiver, a suitable "award" for the PWAC grand champion, and, of course, the rules that would cover competitor selection plus exactly what a competitor would have to do to become PWAC Grand Champion. In due course, the rules underwent much iteration as the group of co-conspirators that had formed around the PWAC concept considered who should be allowed to fly, what they'd fly, how they'd fly, and when they'd fly.

After months of discussion, we opted to take a conservative path and make the first PWAC as simple as possible to enter and to stage. Thus, the rules for the first PWAC were as follows:

- The PWAC was open to qualified competitors from any country.
- In order to qualify to compete in the PWAC, a prospective competitor had to have valid pilot's credentials for flight in the United States, had to register to fly an aircraft that had passed IAC technical inspection criteria, and must not have previously competed in an IAC Intermediate or higher level category, or international equivalent category.
- The PWAC itself consisted of a single flight judged by five IAC credentialed judges under the same IAC rules for judging IAC Primary category competition flights.
- Qualified competitors had to fly either the current IAC Primary Known sequence or their own freestyle sequence.
- A PWAC freestyle sequence had to have a K-factor equal to or exceeding that of the current IAC Primary Known sequence. Freestyle sequences had to be approved by the PWAC chief judge and the requisite number of copies submitted prior to the championship.
- Qualified competitors had to fly the PWAC flight wearing the official "Aspiring PWAC Competitor" T-shirt that they were presented at the PWAC briefing.

At the start of the first PWAC there were nine competitors flying a variety of aerobatic aircraft: two Decathlons, two Christen Eagles, one Pitts S-2A, one Pitts S-1, two Extra 300s, and one Zlin 242. There was no shortage of volunteers and qualified judges for the Championship—all recruited during the Apple Cup competition. In fact, there were more volunteers than were needed: the entire set of judges from Apple Cup all wanted to sit on the PWAC judging line.

Logistically the championship ran like clockwork as everyone got into the spirit of hosting an "International Championship." In addition, unlike WAC and AWAC, the entire logistical setup for PWAC had been finalized over exactly two days—the two days of the Apple Cup competition. Clearly there is an advantage in having fewer organizations involved in setting up a championship!

Eight competitors elected to fly the IAC Primary Known sequence. Only one competitor, Bob Harris of Chapter 77 flying his Extra 300S, submitted a freestyle sequence—essentially a single figure sequence of appropriate K-factor. Once the order of flight was chosen and the scoring software set up, the chief judge, her five judges, and their support volunteers took their places out on the judging line. With the box now set for the PWAC flight, the competitors quickly lined up their aircraft, and every few minutes the starter launched them one by one into the aerobatic hold.

The entire championship was completed within an hour—a record that likely will never be broken by

any international aerobatic event. Furthermore, there were no challenges or protests lodged. In fact, the PWAC Jury simply kicked back in the shade and watched the excellent flying.

In keeping with its international nature, the honor of being the first PWAC Grand Champion was won by a Canadian pilot—Sam Roland of Victoria, British Columbia. Sam flew a U.S. registered Decathlon that he "borrowed" and scored an impressive 82.76 percent. He was overwhelmed later at the awards banquet when presented with the magnificently massive Grand PWAC'R Cup.

WHAT'S IN STORE FOR THE FUTURE?

PWAC will be held again next year immediately following the Apple Cup Regional Competition. Increased participation is expected due to a plan to allow competitors with any level of prior competition experience to compete. Be warned though: Those with competitive experience above Primary or Sportsman will fly with certain specified "handicaps." Handicaps currently under consideration include having PWAC competitors with prior Unlimited or Advanced competition experience fly the Primary sequence entirely on a vertical line (with an outside snap substituted for the spin). There is also an unconnected proposal that all competitors with prior Intermediate or higher competition experience fly the entire Primary sequence without power—just dive into the box, pull back the throttle, and go for it … and, of course, they'd be restricted to fly within the lateral box boundaries or risk penalties. And, of course, we are considering a glider PWAC.

The PWAC would have been impossible to stage without the unfailing support of the Northwest region's local IAC chapters. The people involved—all the volunteers—deserve a big thank-you. In addition to running one of the biggest IAC chapters and Apple Cup regional competitions, Contest Directors Ann Marie Ward and Carol Burch went out of their way to host the PWAC. IAC Chapter 77 provided the first PWAC chief judge, Jennifer Haglund, who ran a tight ship out on the judging line.

Conceived as a "Championship," PWAC also had a few other dimensions. Promotional activities, including merchandizing, started months before the event. An official photographer had to be appointed—which was a bit challenging because the Apple Cup photographer had to decline the invitation as he was competing in PWAC. Naturally, PWAC also had a budget established: $0.00 (an anonymous benefactor donated the Grand PWAC'R Cup). At the conclusion of the Championship, PWAC had exactly met its budget!

The lessons from PWAC are straightforward and apply to the worldwide aerobatic community: First, as we all know, you can have great fun flying aerobatics in any category or level of participation. Second, it's hard to find a group more dedicated than the aerobatic community when it comes to pitching in and making something new happen!

UPPER: Sam makes a moment for a fan's camera. BELOW: An enthusiastic crew of innovative volunteers and judges made the dream of PWAC a reality.

Ask Allen

A master rigger answers your questions about parachutes.

By Allen Silver, IAC 431160

Q: What do I do with excess leg and chest strap webbing?

A: In a previous column, I mentioned the need to have elastic keepers to stow excess webbing. Since then several people asked how this should actually be done. The simple answer is to do what is most comfortable for you. I suggest looking at the following pictures and choosing what fits your needs (see figures 1 and 2 on opposite page).

If the leg and/or chest straps are really long, they can be shortened by a master rigger. Do not attempt to do this on your own. It's tempting for a "home-rigger" to just cut the excess from the straps. After all, how difficult can it be? And think of the money and time saved by not going to a parachute rigger! Please leave this to the professional master rigger. Only a master parachute rigger (or the manufacturer) can make alterations to a harness. A senior rigger can do it, but only under the direct supervision of a master rigger.

On all leg straps and some chest straps, the free end of the webbing must be folded back over itself one or two times and sewn with the proper thread. This prevents it from unthreading through the metal adapter when it's needed the most, during deployment. Under the stress of an actual opening, the harness webbing can easily stretch 10 percent to 20 percent. If the end of the webbing is too close to an adjustable snap or friction adapter (see figures 3 and 4), you may be in for a surprise if it pulls itself out during an opening shock.

Even if the end of a leg strap is folded and properly sewn, do not ever leave the folded end right up against the metal adjustable leg snap or friction adapter. During an actual opening, it could rip apart and unthread itself. Some pilots like to roll the webbing right up against the adjustable adapter. When that happens the adapter may not be lying flat and the webbing can easily slip. The webbing should never be so close to the adjuster that it lifts it up. Leave at least 2-3 inches between the end of the webbing and any metal adapter it runs through just to be safe.

Q: What FARs apply to my parachute rigger?

A: If you want the entire answer, curl up with a copy of 14 CFR Part 65. This section prescribes the requirements for issuing a parachute rigger rating and the general operating rules for the holder of this certificate. Keep in mind that this section has not been revised in more than 50 years! Much of Part 65 talks about the requirements to be certificated, eligibility, and privileges. After you've determined that your rigger has the correct rating for your type of parachute (Part 65.121), you should be concerned with Part 65.127. This section discusses facilities and equipment.

It says you must have a "smooth top table at least three feet wide by forty feet long." Is this requirement really necessary? Probably not, but that's what the rule says. However, most FAA officials recognize that modern parachutes have changed and will only be looking for a clean surface. This could be a table or a mat on the floor. If your parachute will be packed on the floor, be suspicious of any place that does not have a clearly defined area that is clean and kept free of people walking in that area. For example, packing on a carpet works just fine as long as it is kept clean of contaminants, including whatever people have tracked in on their shoes.

Part 65.127 also requires "suitable housing that is adequately heated, lighted and ventilated." It also mentions "enough packing tools." Up-to-date packing manuals are not specifically mentioned, but should be included as a tool. If your rigger doesn't have a current manual, most can easily be found online at the manufacturer's website, or call the company and it will send you a manual.

I'll see you in December, and please keep your questions coming.

Allen Silver is the owner of Silver Parachute Sales and is always available to answer your questions about parachutes. Send your questions to ***Allen@silverparachutes.com.***


Fig. 1


Fig. 2

Figures 1 and 2: There are many ways to safely stow excess webbing.


Fig. 3


Fig. 4

Figures 3 and 4: Be sure excess webbing is not stowed too close to adapters as they could cause the adapter to loosen during deployment.

mishaps data

Compiled by Bruce Johnson

MISHAPS BY MONTH

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2006	0/0	1/2	1/1	1/0	1/1	1/0	0/0	1/0	0/0	1/1	1/1	1/2
2007	0/0	0/0	1/1	0/0	0/0	1/2	1/1					

MISHAPS BY YEAR

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Mishaps	20	26	21	24	20	18	12	9	15	9	10	16

Numbers depict accidents/fatalities of total accidents in the U.S. by aerobatic aircraft. Accidents included are only those which occurred during aerobatic maneuvering (including air shows) or during an IAC-sanctioned competition.

The following preliminary report is that of Jim LeRoy's fatal accident at the Dayton Air Show in July. From reports to me from those who were there, the weather required a modified "low show" act. From videos it appears that Jim was executing snaps on a 45-degree downline when he crashed.

Preliminary

Accident occurred Saturday, July 28, 2007, in Dayton, OH.
Aircraft: Opus Motorsports LLC BD02, Registration: N98MF
Injuries: 1 Fatal

This is preliminary information, subject to change, and may contain errors. Any errors in this report will be corrected when the final report has been completed.

On July 28 at about 1437 Eastern Daylight Time, N98MF, registered as an Opus Motorsports LLC BD02 airplane, sustained substantial damage on impact with terrain during an air show maneuver at the James M. Cox Dayton International Airport (DAY), near Dayton, Ohio. A post-impact fire occurred. The aerobatic flight was operating under 14 Code of Federal Regulations Part 91. Visual meteorological conditions prevailed at the time of the accident. No flight plan was on file. The pilot sustained fatal injuries.

Final

Accident occurred Saturday, June 3, 2006, in Antioch, CA.
Probable Cause Approval Date: June 27, 2007
Aircraft: Aviat Aircraft Inc Pitts S-2B, Registration: N117PS
Injuries: 1 Uninjured

On June 3, 2006, at 1435 Pacific Daylight Time, an Aviat Pitts S-2B, N117PS, lost oil pressure in flight and the pilot performed a precautionary landing in a hay field in Antioch, California. The airplane nosed over and sustained substantial damage. The commercial pilot, the sole occupant, was not injured. The airplane was registered to a private company, and the pilot was operating it under the provisions of 14 CFR Part 91. Visual meteorological conditions prevailed, and no flight plan had been filed for the local, personal aerobatic flight. The pilot departed from Livermore Municipal Airport (LVK), Livermore, California, at 1400.

The pilot reported that while performing an aerobatic sequence, the engine lost oil pressure and he elected to perform a precautionary landing in a field. The pilot shut down the engine after 15 seconds, when he had his landing spot secured. During the landing roll, the airplane nosed over in the muddy terrain.

The Federal Aviation Administration (FAA) accident coordinator examined the engine following the accident. The engine oil sump contained approximately 9 quarts of oil. The oil pressure gauge was tested, and no operational anomalies were noted. The engine was test run; however, the oil pressure gauge did not indicate positive pressure. The oil pump was removed from the accessory case and was turned by hand. Oil was present within the oil pump and coated the gears and shaft. No heat signatures were evident.

The airplane was equipped with a Christen inverted oil system. The oil valve works through the means of gravity-operated ball valves, which include two balls and a spring. During normal flight, the top ball valve is closed and the bottom ball valve is open. During inverted flight, the opposite is true. The oil valve was disassembled. Within the valve, a metal piece approximately 1/2 inch in length was identified between the two balls. Later disassembly of the engine showed that portions of the number five piston skirt had fractured from the piston. Pieces of the fractured skirt were identified in the oil sump and filter.

The National Transportation Safety Board (NTSB) determines the probable cause(s) of this accident as follows: The loss of oil pressure due to metal pieces from the number five piston skirt in the oil system, which prevented the oil valve top ball valve from seating. The muddy terrain was a factor.

CLASSIFIEDS

AIRCRAFT

2000 Sukhoi 31, low time, excellent condition. Call Pete **520-906-0770.**

MISCELLANEOUS

AIRPLANE T-SHIRTS - 150 Different Airplanes Available. WE PROBABLY HAVE YOUR AIRPLANE. ***www.airplanetshirts.com*** or call **1-800-645-7739.**

GEAR LEG ADAPTORS for Cleveland wheel and brake assemblies for Sukhoi 26, 29, and 31. Call Pete at **520-906-0770.**

Gap Seal – Still the best rudder and elevator gap seal for Pitts and Eagle aircraft. For aircraft with strap hinges (not pin hinges). $72 for S-1 models, $96 for S-2 and Eagle, $120 for Model 12. Add $8 for shipping and handling inside the US. Google Rihn Aircraft for more information. Mail check to: Rihn Aircraft Corp, 4357 Candleberry Ave., Seal Beach, CA 90740 or contact ***danrihn@aol.com.***

PARACHUTES

PARACHUTES – Absolutely the Best Prices - STRONG – NATIONAL – SOFTIE, Back-Seat-Chair, Squadrons, 30 years in the business, Master Rigger, FAA Loft, Don Mayer's Parachute Shop, **1-800-872-2488,** ***www.parachuteshop.com.***

Great Deals on New & Used Parachutes. Silver Parachute Sales is a name you have trusted since 1972. When service counts, it pays to shop around. Largest dealer for SOFTIE parachutes. FAA Master Rigger and Examiner. **510-785-7070** ***Allen@silverparachutes.com.*** For prices, safety articles and other services, visit ***www.SilverParachutes.com.***

FLYMART

Classified Advertising Rates: Classified Word Ads: $5.50 per 10 words (rounded to the nearest 10 words), 180 words maximum, with boldface lead-in on first line. Classified Display Ads: One column wide (2.167 inches) by 1, 2, or 3 inches high at $20 per inch. Black and white only, and no frequency discounts. Rates cover one insertion per issue. Classified ads are not accepted via phone. Payment must accompany order. Word ads may be sent via e-mail ***(classads@eaa.org)*** using credit card payment. Include name on card, complete address, type of card, card number, and expiration date. Make checks payable to IAC. Address advertising correspondence and/or inquiries on rates and mechanical requirements, both B&W and 4 color to: Classified Ad Manager, P.O. Box 3086, Oshkosh, WI 54903-3086. **Deadline** for display ads, space reservations or cancellations is seven weeks prior to publication date. i.e., April 10th for June issue, etc. However, ad materials/copy can be received at a later date providing space has been reserved. Classified ads accepted daily for next available issue.

meet a member

Photos courtesy Ron Schreck

Name: Ron Schreck

Occupation: Commercial pilot

Location: Gold Hill, North Carolina

Family: Wife Kathy and children Jenny 34, Scott 31

Certificates and Ratings held: ATP, SEL, MEL, SE Sea, Glider

Aircraft flown: I have flown a variety of airplanes, including T-37, T-38, OV-10, A-7D, F-105D/F/G, F-4E/G, F-17A/B/C/D, Fokker F-28, B-727, B-737, B-757, B-767, Airbus 319/320/321, Van's RV-8, Cessna 150, 172, 337.

What drew you to flying and aerobatics?

My father was a B-25 pilot in WWII, and I discovered aerobatics as part of Air Force pilot training.

What kind of airplane do you fly?

I fly a Van's RV-8 named Miss Izzy (the airplane is named after my granddaughter, Isabelle). I built it myself in 3-1/2 years, and I have logged more than 310 hours in the first 16 months since she was first flown. I regularly fly with two-ship formation demonstration teams in Georgia and the Carolinas and am carded as a Formation Flight International flight lead.

Do you plan to participate in aerobatic competition?

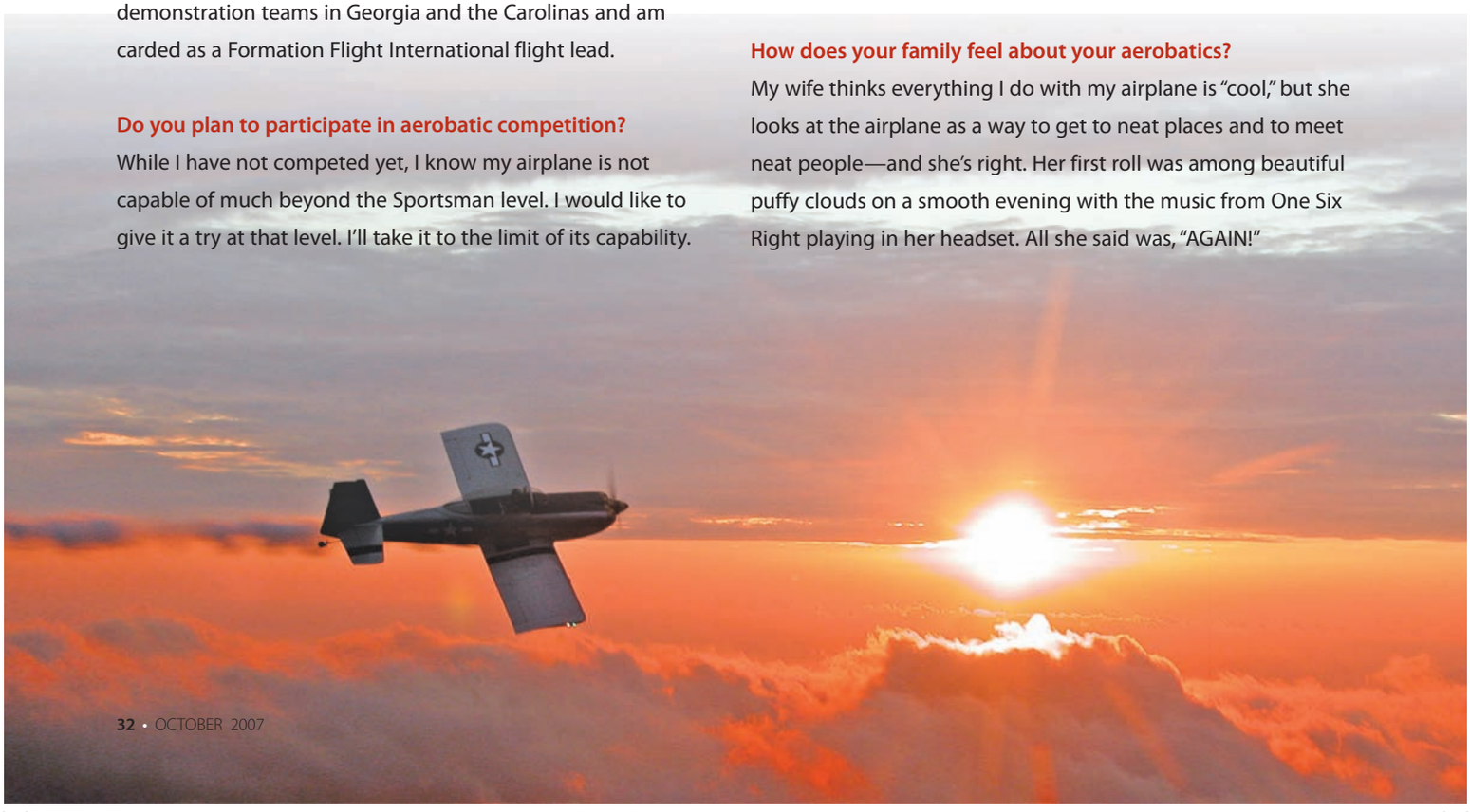
While I have not competed yet, I know my airplane is not capable of much beyond the Sportsman level. I would like to give it a try at that level. I'll take it to the limit of its capability.

Who do you admire in the sport?

I admire anybody who feels just as comfortable inverted as they do right-side up!

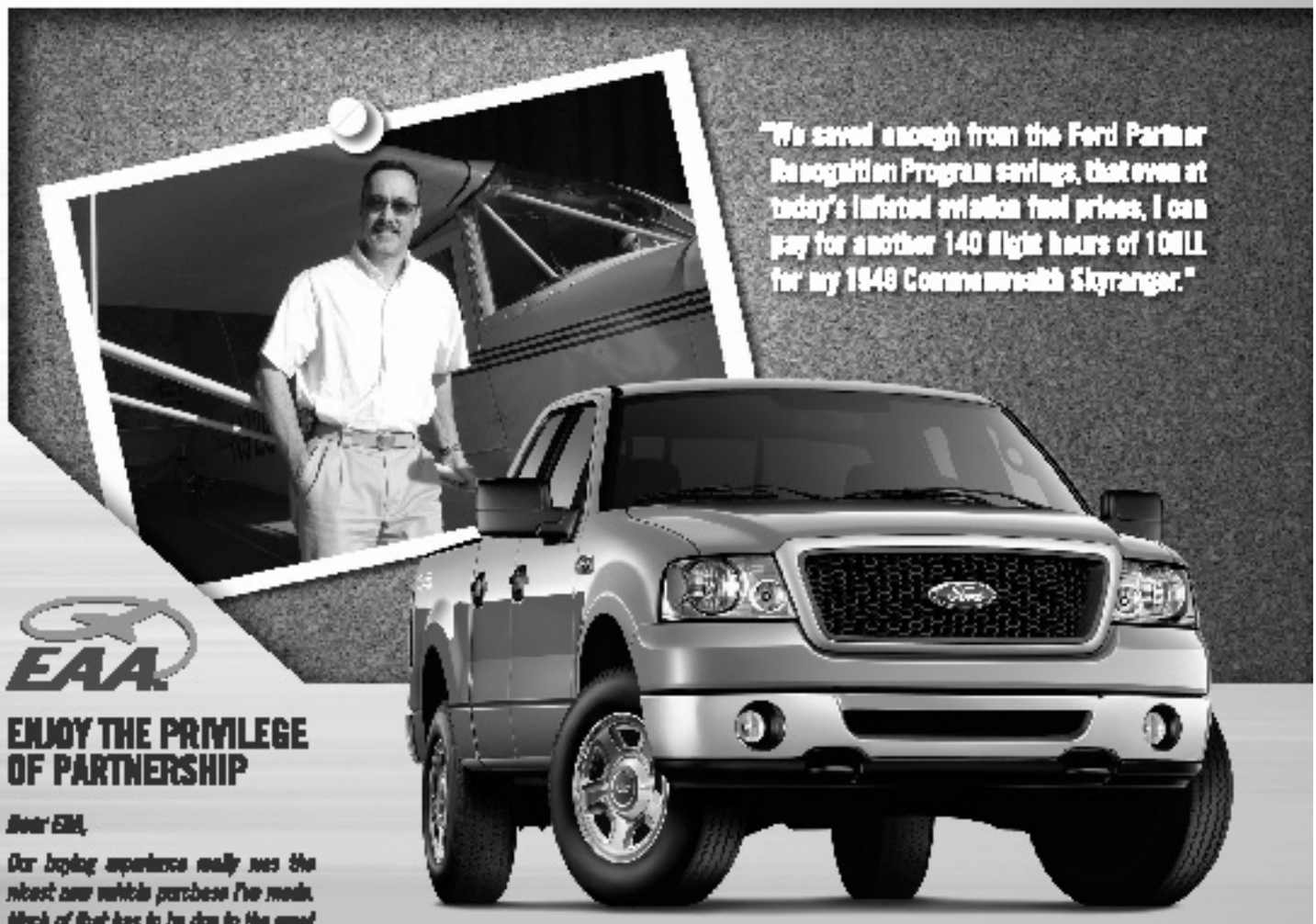
How does your family feel about your aerobatics?

My wife thinks everything I do with my airplane is "cool," but she looks at the airplane as a way to get to neat places and to meet neat people—and she's right. Her first roll was among beautiful puffy clouds on a smooth evening with the music from One Six Right playing in her headset. All she said was, "AGAIN!"



partner recognition

X-PLAN VEHICLE PRICING



EAA

ENJOY THE PRIVILEGE OF PARTNERSHIP

Dear EAA,

Our buying experience really was the nicest new vehicle purchase I've made. Much of that has to be due to the great dealer we had with Nilson Motors in Corvallis, Oregon, but a good part is also that the Ford Partner Program is treated by Ford and its dealers as a discount from the factory and not a reduction in the commission that the dealer or salesman gets. The local dealer is not forced to pay for this benefit and therefore they see only upside on the deal. And that means that the customer sees only upside too. We saved enough from the Ford Partner Program savings that even at today's inflated aviation fuel prices I can pay for another 140 flight hours of 100LL for my 1946 Commonwealth Skyranger.

Best Regards,

Mel R.
Eagleton, Oregon
EAA Member

2007 Ford F-150 continues to offer the industry's widest variety of body configurations, including three cab choices, three box lengths, two box styles and five unique series including the powerful, but luxurious F-150 Lariat.

EXCLUSIVE PRICING, EXCEPTIONALLY SIMPLE!

Ford Motor Company, in association with EAA, is proud to offer members the opportunity to save on the purchase or lease of vehicles from Ford Motor Company's family of brands—Ford, Lincoln, Mercury, Mazda, Volvo, Land Rover and Jaguar.

Get your personal identification number (PIN) and learn about the great value of Partner Recognition/X-Plan pricing from the EAA website (www.eaa.org) by clicking on the EAA/Ford Program logo. You must be an EAA Member for at least one year to be eligible. This offer is available to residents of the United States and Canada.

Certain restrictions apply. Available at participating dealers. Please refer to www.eaa.org or call 888-843-3615.

VOLVO MAZDA LINCOLN FORD MERCURY JAGUAR LAND ROVER