COZY AIRCRAFT FORUM

Soup to Nuts*?

Marc J. Zeitlin

July 27th, 2012

1:00 PM – 2:15 PM

Forum Tent 02 – GAMA Pavilion

* With apologies to Bernard Kliban

What Will I Talk About?

- ***Standard Introduction for the Newbies – 15 min.***
  - ***Who Am I?***
  - ***What's a COZY MKIV?***
  - ***Why a COZY MKIV***
  - ***COZY MKIV Plans***
  - ***COZY MKIV Cost***
  - ***COZY MKIV Support***
  - ***COZY MKIV Parts Vendors***
  - ***How Many COZY's Under Construction / Flying?***

- ***Further Topics – 30 min:***
  - ***COZY Aircraft Structures***
  - ***Flight Testing Methods***
  - ***COZY Engine choices***
  - ***Fuel Compatibility***
  - ***Strake Mod. Aerodynamics***
  - ***Common Modifications***
  - ***Performance Mods***
  - ***COZY Accident Record***
  - ***Safety Mods/Issues – Aging of Fleet***
- ***Futures / State of Design***
- ***Questions and Answer (ANY topic)***

Who The Heck Am I?

- Biography / Resume'
  - http://www.mdzeitlin.com/Marc/bio.html
- Built Quickie Q2
- Built COZY MKIV #386, N83MZ – ~860 flying hours
- Started / Administer Unofficial COZY Builders Web Page and COZY Mailing List (~682 members)
- Work for ICON Aircraft as Lead Systems Engineer

- Since May 1st, 2011, I provide **OFFICIAL** technical support for **COZY** aircraft to all builders, flyers and prospective builders

What's a COZY MKIV?

- Aircraft Type
  - Canard pusher – big wing in rear, small wing in front, engine in rear
  - 4 place, or 2+2, or 2 + LOTS of baggage
  - Efficient, fast, long distance cruiser – have traveled over 1000 NM/leg and from Tehachapi, CA to Cleveland, OH in daylight

- History of the COZY MKIV
  - Designed by Nat Puffer as a derivative of Burt Rutan/RAF's Long-EZ
  - First as a side-by-side two seater in mid-80's
  - Next, added single rear seat (kept Long-EZ rear end, spar and wings)
  - Evolved from 3-place to current 4-place MKIV in early 1990's – rear end modified to be similar to Defiant landing gear/firewall structure; canard airfoil updated

- COZY/canard aerodynamics – Nat's 2005 Oshkosh Forum
  - http://www.cozybuilders.org/Oshkosh_Presentations/Nats_OSH2005_Presentation.pdf

Why a COZY MKIV?

- You want to **BUILD** an airplane
- Use-Model – your comparison indicates a COZY is the type of aircraft you want to fly – shouldn't be because "ooohhh, that's a cool looking plane"
- Economics – a COZY MKIV can be flown for less than renting a C-172 with fewer fuel stops in less time
- Carrying Capacity – you need more than 2 seats, or 2 seats and LOTS of baggage space
- Safety Features – you want a canard's stall/spin resistance
- Composites – you like the build materials

COZY Plans Availability

- Cozyaircraft Corp. owned by ACS since 2004

- Plans available through ACS

http://www.aircraftspruce.com

Vendor Display Building “A” at OSH

COZY MKIV Cost

- Low End - $35K to $50K
  - High time engine (maybe auto conversion)
  - Good scrounging
  - Minimum instruments - VFR only
- Mid-Range - $50K to $75K
  - Some prefab (not much)
  - Rebuilt engine
  - High end VFR - Low end IFR panel
- High End - $75K to $120K
  - Lots of prefab components / paid help
  - New Lycoming
  - Complete latest IFR stack panel
- Plans – NOT A KIT!!! This means you can customize your spend rate, as well as what you spend money on. Cost control is completely up to you, your desires, needs, and ability to pay

COZY Support Methods

- **Official support from me (my contact info on last slide), afforded by ACS (thanks, Jim Irwin!)**

- Freeflight Composites (Burrall Sanders)
  - http://www.freeflightcomposites.com/services.htm

- COZY Newsletter archives
  - http://www.cozybuilders.org/newsletters/
- COZY Mailing List
  - http://www.cozybuilders.org/mail_list/
- **U**nofficial **C**OZY **B**uilders **W**eb **P**age (UCBWP)
  - http://www.cozybuilders.org/
- Canard Aviator's Mailing List
  - http://groups.yahoo.com/group/canard-aviators/
- CSA Newsletter (mandatory for all canardians)
  - http://www.cozybuilders.org/ref_info/other_news.html
- Other builder's web pages (links from **UCBWP**)

COZY Parts Availability

- ACS, Wicks, etc. for most composite & standard aircraft materials

- Two main vendors provide metal parts:
  - CG Products
    - http://www.cozygirrrl.com/aircraftparts.htm
  - EZ Noselift
    - http://www.eznoselift.com/

- Other part vendors for miscellaneous items – see:
    - http://www.cozybuilders.org/newsletters/suppliers.html
    - http://www.cozybuilders.org/newsletters/na_suppliers.html

How Many COZY's?

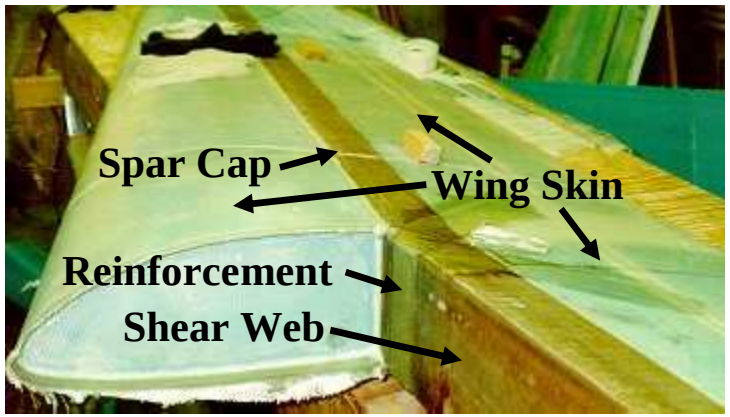
- ~ 2000 Rutan Derivative Canard Aircraft flying (VariViggen , V.E., L.E., Defiant, Berkut, E-Racer, SQ2000, Velocity, COZY III, COZY MKIV)
- ~ 250 - 350 flying COZY's all over the globe
- ~1650 COZY MKIV plans sold
- ~ 600-800 actually under construction
- 5-10 new COZY MKIV first flights per year

- These numbers are **ALL ESTIMATES –** real stats are hard to come by

COZY Aircraft Structures

- Lack of structural failures in type is **NOT** a license to make structural mods, **HOPING** that the (**UNKNOWN**) safety factor will save your butt!
  - Only known testing **to failure** are on L.E./V.E. canard – one failed at 14G, another at 6 – 7G's – shows variability in MFG and structural capabilities
  - At least one L.E. wing test done – no details known
  - **NO COZY MKIV** structural testing has **ever** been done! Do you know the safety margins? I don't! Nat never published any structural design info or analysis – Neither did RAF for Long-EZ
  - Modifications to composite structures are far more complex and difficult to analyze than with metal structures

- Wing/Canard:
  - Spars: Carry bending loads in wings
  - Shear Webs: Carry shear loads in wings – transfer loads from top to bottom
  - Skins: Carry twisting loads in wings



- Fuselage:
  - Bulkheads: Stiffen fuselage in bending (sideways) and twisting
  - Sides: Stiffen fuselage in bending and twisting
  - Longerons: Help stiffen – mostly act as mounting "hardpoints"
  - Reinforcements: On LG Bulkheads/Firewall/Seatbelt Attach/Canard Attach - Thicken, hardpoints, transfer loads between major structures

COZY Aircraft Structures (continued)

- August, 2011 **Sport Aviation** article by **Dick VanGrunsven** (designer of all RV aircraft) addresses overweight/overpowered aircraft – specifically an award winner RV-10 written up in Sport Aviation!

- A couple of quotes from Dick:

  – …Any "penciled in" gross weight increase is just wishful thinking. **The laws of physics are not repealed by wishful thinking.**

  – **WHO OWNS THE MARGIN?**
  It seems common practice among homebuilders to second-guess the factory engineers, particularly regarding gross weight increases. Because of all of the added features, empty weight creep erodes the aircraft's useful load. The simple solution for the homebuilder is to "pencil in" a new gross weight limit. "It's only 100 pounds (3.7 percent) more; how much eff ect can that possibly have?" Imagine this example: You are on a mid-size airliner with a gross weight of 270,000 pounds. Just before leaving the gate, the captain comes on the PA system and says: "We've overbooked more than usual today, so we're going to assume that the factory engineers over-designed this airplane and allowed an abundant safety margin. We're going to take off at 280,000 pounds instead. So move over, there are 50 more passengers coming on board." Run the numbers; it's the same over-weight ratio as simply pencilling in an additional 100 pounds to the gross weight of an RV-10.

  Along with gross weight increases, some builders take the same liberties with horsepower increases and speed increases, betting their lives on the assumption that the airplane is designed with a huge margin of safety—it is really far stronger than it needs to be. This is not really true. **Certificated aircraft, and well-designed kit aircraft, are designed to withstand limit loads at specified maximum weights. During testing, they are subjected to ultimate loads, which are higher than design limit loads by a specified margin. Yes, there is a margin between the design and ultimate strengths. But that margin belongs to the engineer. He owns the margin. It is his insurance against the things he doesn't know or can't plan for, and the pilot's insurance against human error, material variations, and the ravages of time.** Wise pilots respect this design safety philosophy and leave this insurance policy in effect by operating strictly within established limits.

- Emphasis in **red** MINE…

Flight Test Review

- **NOTE:**
  - Flying around in circles for 40 hours at one CG is **NOT** flight testing, especially in a custom, plans built aircraft, no matter how many people **SEEM** to get away with it
  - Your airplane is **NOT** identical to any other airplane on the planet, and even if it has the same name as 200 or 2000 other aircraft, it needs to be flight tested as if it was the only one on earth

- **Purpose of Phase I Flight Testing period:**

  Determine **ALL** performance characteristics of airplane at **ALL** corners of the attainable performance envelope

  - Calibrate Pitot Static System – CAS vs. IAS (MUST understand difference between IAS/CAS/TAS/GS)
  - Takeoff / Rotation performance / airspeeds
  - Climb/Cruise performance
  - Descent performance – gear/landing brake retracted, extended
  - Landing performance / airspeeds
  - Stalls / Accelerated stall (more than 1G – performed in 15, 30 45, 60 degree banked turns)
  - Deep stall susceptibility / resistance (at rear CG limit)
  - Static and Dynamic pitch stability (stick fixed / stick free)
  - Lateral stability (spiral, Dutch Roll, Roll/yaw coupling)
  - Flutter susceptibility (stick / pedal raps)

- **Performance Envelope Includes:**
  - Forward, Mid, Aft CG
  - Max Gross Weight (per placard), Middle Weights, Light Weights
  - Full, Mid, Low Fuel
  - Speeds from Vs (aft CG, min weight) to Vne+10%
  - Altitudes from SL to Service Ceiling (or max desired altitude)
  - **ANY AND ALL** maneuvers that may be attempted in Phase II
  - Phase II flight is restricted to flight envelope expanded in Phase I

Flight Test Review (cont.)

- **Flight Test Guidelines:**
  - **AC90-89A** – **EXCELLENT** FAA guide
  - **COZY POH** recommendations
  - **Aerocanard** Flight Test guidelines
  - Use a Test Pilot if not completely capable and current
  - Should take 35 hours **AT LEAST** to perform all required tests – if you're think you're done after 10-25 hours, you **haven't done enough testing!!**

- **CG Determination:**
  - CG is even more critical for canard aircraft, with relatively small CG ranges and deep stall susceptibility
  - Need **ACCURATE** empty CG – implies accurate weighing
  - Bathroom scales are **NOT** accurate enough – need/use calibrated aircraft scales
  - Can weight with ballast / passengers / pilot for more accurate station information
  - Use accurate spreadsheet / calculations to determine flight CG – see sample on **COZYBUILDERS** web page
  - Use weights (lead, steel, sandbag, water container) at appropriate station to set CG during testing
  - One stretched COZY had substantial stability issues early in flight test due to incorrect CG range determination

- **Flight Test Procedures:**
  - No friends, observers, family – only required test crew – don't need pressure to perform
  - Be ready to cancel **ANY** test and **ANY** flight for **ANY** reason if everything is not "just right" (weather, physical condition, aircraft readiness, airport issues, etc.)
  - Have a planned and practiced "test card" for each flight – plan **EVERY** flight completely – all actions and all coms – do not deviate except in an emergency
  - Sample test cards available from other builders
  - Start testing in **CENTER** of CG range
  - Start testing at light weights
  - Slowly add weight and move forward and aft within CG range
  - Start with mild maneuvers
  - Start with short flights – 20 - 30 minutes
  - Runway flights OK if have **LONG** runway
  - Gear stays down on first few flights – verify
  - Need to be able to hold airspeeds to within 1-2 kts.
  - Need to be able to hold altitude to within ~20 - 50 ft.
  - Need to document everything – take notes, record audio, run video camera – whatever works for you – you won't remember everything

COZY Engine Choices

FLYING:

- Lycoming O-360 / O-320 – many variants
  - Hundreds flying successfully
- Lycoming O-540 (only marginally "alternative")
  - Three flying successfully (Jannie Versfeld / Chris Esseltstyn / Scott Carter)
- Jabiru 5100
  - One flying successfully (Larry Hill)
- Subaru -
  - Two flying (different variants) semi-successfully (Al Wick / Keith Spreuer)
- Twin Suzuki -
  - One flying successfully in Venezuela (Leon brothers)
- Rotary (Mazda 13B variants) -
  - Two flying – low flight time, numerous engine related incidents (John Slade / Steve Brooks)
  - Two others removed for Lycomings after minimal flight time (Joe Hull / Bulent Aliev)
- V8 variants -
  - One flying in South Africa (Rego Burger) (few hours due to accidents – one engine related)
  - One removed long ago and replaced with Lycoming
- Turbo-prop (Allison) -
  - One flew – crashed during Phase I in 2008 (cause unknown)
- Jet Turbine -
  - One flying successfully (Greg Richter)

IN DEVELOPMENT:

- One Continental IO-360
- Numerous Mazda 13B and 20B variants
- Different Subaru (H3.0 turbo – Al Wick, SVX – Phil Johnson)

POSSIBILITIES (no breath holding):

- New Lycoming Variants (not major stretch)
- Deltahawk Diesel (expensive & not available)
- Mistral Rotary (**VERY** Expensive)

AUTO CONVERSION ISSUES:

- Difficult development – every one different than all others
- Hard to compete with simplicity of air cooled Lycoming, for all its faults
- Potential? **YES**. Actuality? **NOT YET** - Needs a **LOT** more development work

Common Modifications - Major

Description	Pros	Cons	Notes
Remove Lower Winglets	Aesthetics to some	Decrease rear CG range limit – deep stall susceptibility	Nat Puffer - mandatory to have LW's on COZY MKIV
Raise Canopy 1" – 2"	More headroom	Slightly more drag	Nat Puffer Approved
Widened Canopy	More head/shoulder room	Slightly more drag	Aerocanard Style
Forward Hinged Canopy	Major safety improvement	More complex/heavier	Cosy Classic style
Long-EZ type strake shape ("Cozygirrrl")	Elbow room	Can't install fuselage side windows	Cozygirrl style - Per previous slide
Original Length Canard	Better performance at very forward CG's	Requires CG range modification	Nat Puffer Mandatory to cut 6" from original length
Retractable Main Gear	Slight speed increase	Extreme complexity and increased failure probability	Nat Puffer – not recommended

Common Modifications - Minor

Description	Pros	Cons	Notes
Electric Nose Gear	Easier to raise nose – can raise with passengers – saves old folk's backs	Slight weight increase	Nat Puffer Approved
Electric Landing Brake	Saves weight, space, lower failure rate	None	Nat Puffer Approved
Move Landing Lights	Remove air entry to cockpit	Have to figure out for self	
Hanging Rudder Pedals	Gives free floor space for heels	Complex / heavier than plans	Velocity style – might be a few flying
Eliminate Fuselage Access Door	Fix air/water ingress	Have to have other method of opening from outside	
Main Gear Leg Fairings	Small speed increase	Time to install	
Nose Wheel Doors	Reduce air ingress to cabin / noise reduction	Slight complexity	
Electronic Ignition	Greatly increased efficiency	Unless using Pmag, need backup electrical system	
Fuselage Side Windows	Greatly increased visibility	Time to install	

Performance Modifications

• Wheel Pants (size / design)	- 8 to 12 kts
• Main Gear Leg Fairings	- 3 to 5 kts
• Retractable Landing Gear	- 0 to 20 kts
• Cowling/Cooling (airflow / boat-tail / exhaust)	- 0 to 15 kts **potential**
• Nose Wheel Door	- ?? (small)
• Winglet Intersection Fairings	- ~1 to ~4 kts
• Spinner	- 0 to 1 kts
• Electronic Ignition	- 5% - 10% fuel efficiency

- Appropriate VG's (per **Mark Beduhn's** installation):
  - Decrease landing speed - 7 to 10 kts
  - Decrease top end speed - 1 to 3 kts

COZY Accident Record - Fatal

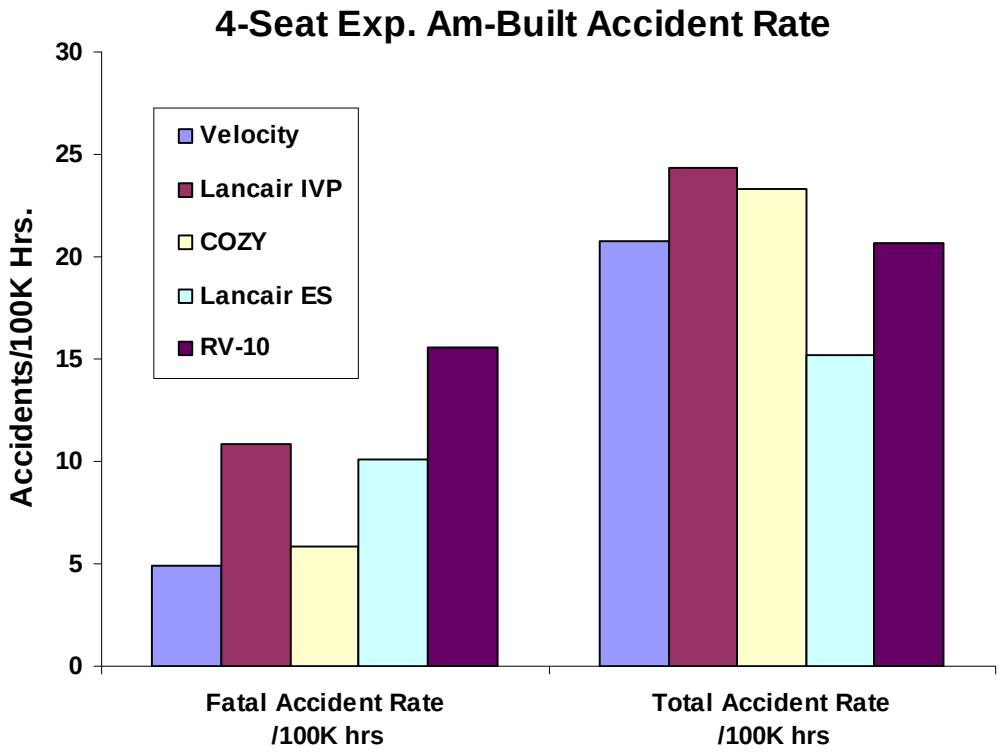
Date	Phase	Severity	Type	Registration	Plans #	Country	Pilot		Category	Keywords	Notes	Report Version
							First Name	Last Name				
21-Sep-94	1	Fatal	MKIV	N151JE	MKIV-389	USA	James	Edwards	Pilot Error	Landing, Rollover	Hard landing - rollover and burn	NTSB Final
1-Jan-95	2	Fatal	MKIV	N5037	MKIV-041	USA	Charles	Larson	Pilot Error	Approach	Low approach - snag wires	NTSB Final
16-Jun-01	2	Fatal	Classic	F-PRSC	Classic-593	France			Pilot Error	Canopy Opening	Canopy open on takeoff - pilot distraction	BEA Final
18-Jan-02	2	Fatal	III	N41CZ	III-081	Mexico	Anoir	Rizk	Weather	Landing	Severe wind shear on landing	NTSB Final
5-Mar-03	2	Fatal	Classic	F-POZY	Classic-???	France			Pilot Error	Maneuvering	Low altitude maneuvering over village	BEA Final
24-Jul-04	2	Fatal	Classic	F-PSCF	Classic-???	France	Saul	Halter	Pilot Error	Deep Stall	Sharp climb and stall on takeoff - suspected improper build and CG problems - Fire	
12-Dec-07	2	Fatal	Aerocanard	N199JW	AC-20	USA	Risto	Toukola	Pilot Error	Canopy Opening	Prop fouling from open canopy after takeoff	NTSB Final
4-May-08	1	Fatal	MKIV	N14GG	MKIV-573	USA	Gerald	Garrett	Unknown		Turbine engine; crash in ocean	NTSB Final
24-Jul-08	2	Fatal	MKIV	N500K	MKIV-163	USA	James	Marshall	Pilot Error	Maneuvering	Flew into side of quarry at 20 ft. AGL - pictures at http://desastresaereosnews.blogspot.com/2008/07/em-dois-dias-dois-acidentes-na-mesma.html	NTSB Final
27-Mar-10	2	Fatal	MKIV	F-PMGT		France	Guy	Terren	Pilot Error	Approach	Low approach - clip trees	
23-Oct-11	2	Fatal	MKIV	N795DB	MKIV-165	USA	Roland	Bremer	Pilot Error	Fuel System	Fuel mismanagement; crash in trees	NTSB Preliminary
11-Jul-12	2	Fatal	III	N718JT	III-???	USA	Joe	Tischler		Takeoff	Engine Trouble on takeoff??	NTSB Preliminary

COZY Accident Record – non-Fatal

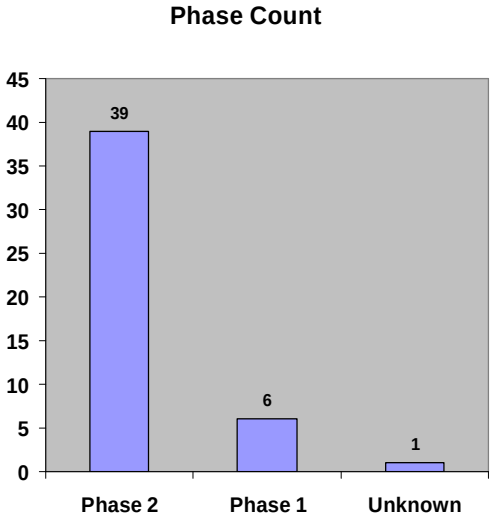
Date	Phase	Severity	Type	Registration	Plans #	Country	Pilot First Name	Pilot Last Name	Category	Keywords	Notes	Report Version
25-Feb-89	2	Non-Fatal	III	N611CZ	III-061	USA	Dennis	Oelmann	Pilot Error	Fuel System	Fuel mismanagement - run tanks dry	NTSB Preliminary
13-Jun-91	2	Non-Fatal	III	N52CZ	III-01	Germany	Uli	Wolter	Aircraft	Engine	Nose seal leak - oil loss - forced landing	
6-Aug-94	1	Non-Fatal	Classic	OE-CYZ	Classic-???	Austria	Valentino	Fry	Aircraft	Engine	Throttle stuck closed	Personal
23-Jun-95	2	Non-Fatal	III	N84CZ	III-71	USA	Keith	Spreuer	Pilot Error	GU Canard, Brake Failure	Canard Contamination - no rotation	NTSB Final
7-May-96	2	Non-Fatal	Classic	N86LM	Classic-006	USA	Robert	Harris	Aircraft	Fuel System, Clogged Filter, Rollover	Clogged Fuel Strainer - rollover	NTSB Final
4-Oct-96	1	Non-Fatal	MKIV	N96PJ	MKIV-203	USA	Pat	Young	Pilot Error	Deep Stall	Vortilon and CG issues	NTSB Final
11-Feb-97	2	Non-Fatal	III	N34PC	III-566	USA	Salvatore	La Barbera	Builder Error	Fuel System	Fuel contamination – hydraulic lines inside tank - loss of power	NTSB Final
26-Mar-97	2	Non-Fatal	Classic	F-PSCF	Classic-???	France			Pilot Error	Takeoff, Rollover	Loss of control during takeoff	BEA Final
22-Jun-97	2	Non-Fatal	Classic	F-PRSC	Classic-???	France			Pilot Error	Landing	Pilot distraction - land short of runway	BEA Final
17-May-00	2	Non-Fatal	Classic	F-WJAK	Classic-???	France			Pilot Error	Takeoff	Canopy open on takeoff - pilot distraction	BEA Final
22-Jan-03	2	Non-Fatal	MKIV	N96PJ	MKIV-203	USA			Pilot Error	Landing	Hard Landing	NTSB Final
26-Jan-03	2	Non-Fatal	MKIV	N320FR	MKIV-???	USA	James	Willar	Pilot Error	Landing, Rollover	Hard Landing - rollover	NTSB Final
30-May-03	2	Non-Fatal	III	N794WD	III-022	USA	John	Totah	Aircraft	Fuel System, Clogged Filter	Clogged Fuel Filter	NTSB Final
16-Nov-03	2	Non-Fatal	III	N534S	III-177	USA	William	Swears	Aircraft	Fuel System	Engine seizure due to oil pressure loss	NTSB Final
2-Dec-03	2	Non-Fatal	III	N238CZ	III-505	USA	Richard	Hughes	Aircraft	Mechanical	Throttle Cable failure - engine power loss	NTSB Final
5-Feb-04	2	Non-Fatal	MKIV	F-PJJP	MKIV-819	France			Pilot Error	Approach, Rollover	Ran off runway - rollover	
17-Jun-04	2	Non-Fatal	III	C-GESK	III-299	Canada	Gaetan	Roy	Aircraft	Fuel System	Fuel Cap came off - break prop blade - force landing on highway	
1-Jul-04	unk.	Non-Fatal	Classic	F-????		France			Builder Error	Structure, Rollover	Canard flutter - rudder failure - land in field - rollover	
10-Jul-04	2	Non-Fatal	III	G-BXDO	III-???	Great Britain			Pilot Error	Rollover	Nose door goes through prop - forced landing	CAA Final
2-Mar-06	2	Non-Fatal	MKIV	ZU-DAR	MKIV-673	South Africa	Jannie	Versfeld	Builder Error	Mechanical	Axle installation failure due to loose bolts	
16-Jun-06	2	Non-Fatal	MKIV	ZU-BNH	MKIV-???	South Africa	Rego	Burger	Pilot Error	Takeoff	Grass runway - no rotation	
18-Jan-07	1	Non-Fatal	MKIV	C-GUZY	MKIV-387	Canada	Licio	Merlo	Pilot Error	Landing, Rollover	Lost control on go-round - low airspeed - rollover	CADORS 22007C0172
1-May-07	2	Non-Fatal	MKIV	ZU-DAR	MKIV-673	South Africa	Jannie	Versfeld	Aircraft	Engine	Exhaust Pipe failure - damage propeller	
5-Jul-07	2	Non-Fatal	Aerocanard	N337DS	AC-???	USA	William	Oertel	Pilot Error	Fuel System	Gas cap departed -fuel loss	NTSB Final
5-Nov-08	2	Non-Fatal	MKIV	N637PS	MKIV-287	USA	Leonard	Johnson	Pilot Error	Landing Brake	Landing Brake extended - engine overheat	NTSB Final
15-Nov-08	2	Non-Fatal	III	N149CZ	III-178	USA	Harland	Hauser	Pilot Error	Landing	Loss of control during landing	NTSB Final
17-Apr-10	2	Non-Fatal	MKIV	N68TF	MKIV-354	USA	Steve	James	Builder Error	Deep Stall	Deep Stall - probable canard span and empty CG calc. issues	NTSB Final
9-May-10	2	Non-Fatal	III	N144TJ	III-452	USA	Richard	Hughes	Pilot Error	Canopy Opening	Pilot opened canopy during flight - damage to propeller	NTSB Preliminary
11-Sep-10	2	Non-Fatal	MKIV	N9699	MKIV-1017	USA	Kevin	Carr	Aircraft	Engine, Rollover	Power Loss - rollover	NTSB Preliminary
30-May-11	2	Non-Fatal	MKIV	N204TJ	MKIV-204	USA	Tim	Jones	Aircraft	Engine	Power Loss	NTSB Preliminary
22-Jun-11	2	Non-Fatal	MKIV	ZU-BNH	MKIV-???	South Africa	Rego	Burger	Builder Error	Engine	Belt failure (V8 engine) in PSRU due to loose bolts in installation	
6-Jul-11	2	Non-Fatal	MKIV	N484BD	MKIV-???	USA	Bulent	Aliev	Other	Not at Fault	Other aircraft taxied into wing on ground - other aircraft at fault	NTSB Preliminary
28-Jul-11	2	Non-Fatal	Classic	F-PFMP	Classic-???	Germany	Klaus	Scheidl	Unknown		Wilksch Diesel power - crash in trees after takeoff	BFU Preliminary
23-Dec-11	1	Non-Fatal	III	ZK-COZ	III-749	New Zealand	Chris	Hoskins	Pilot Error	Takeoff	Canopy open on takeoff - pilot distraction	

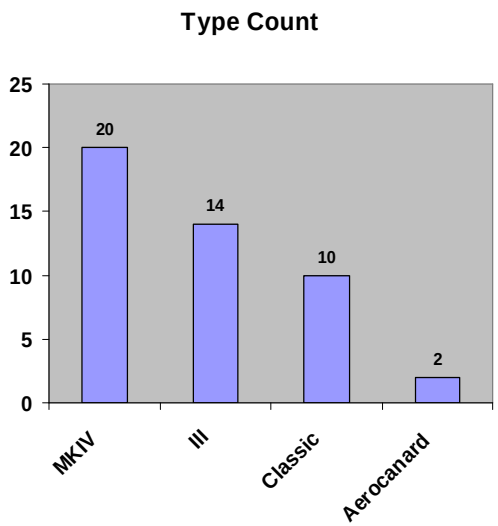
COZY Accident Record

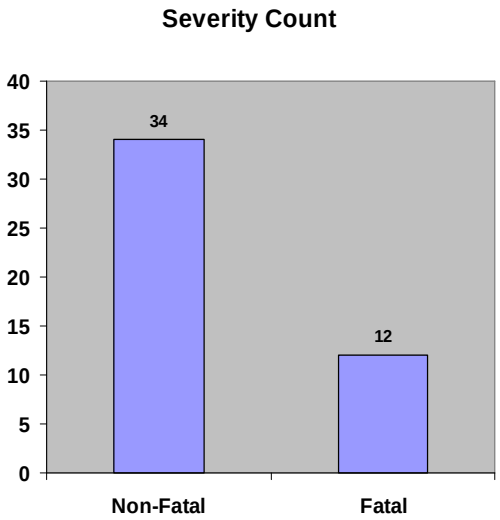
- **NO** accidents caused by structural/aerodynamic failure of ***correctly*** built and flown COZY aircraft – in fact, of **ANY RUTAN/DERIVATIVE CANARD**
- Since 1989, 46 total known COZY accidents
- Accident **RATE** – **Assume** 125 flying (avg.), 60 hrs/yr (avg.), 22 years – 165K hrs total
  - **7.2/100K** hrs **fatal**
  - **6.1/100K** hrs **fatal**, Phase II **ONLY**
  - **28/100K** hrs **total**
  - GA is ~**1.3/100K** hrs (Nall Report)
  - GA is ~**6.3/100K** hrs (Nall Report)
- Phase I accident rate – assume ~350 flying COZY's, 40 hrs/phase I – ~14K hrs total
  - **14.3/100K** hrs **fatal**
  - **42.9/100K** hrs **total**
  - **These #'s VERY suspect due to low hour count**
- Graph as of 2008 for all but COZY – COZY as of 2011

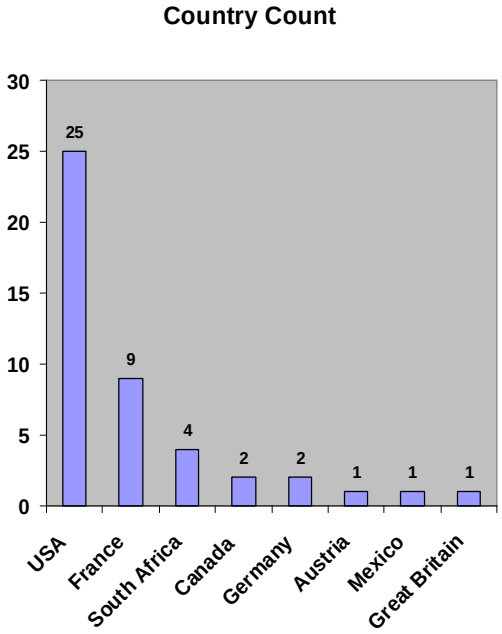


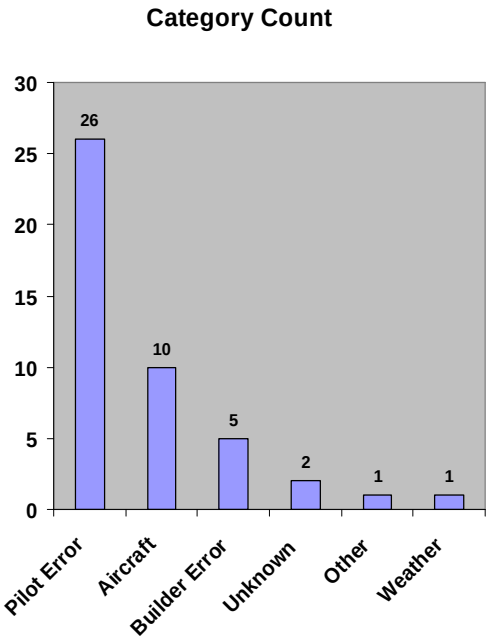
COZY Accident Record











Analysis of Accident Record

- **Flying/Landing Techniques and Pilot (mis)judgment:**
  - Single largest factor – **56%** of all COZY accidents
  - Almost all (10 out of 12) fatal accidents caused by pilot error
  - Under our control – must actively manage and learn
  - Gave presentation on "Judgment" at COZY dinner in 2009 – available on COZY builders web
  - Cause? Training, Low Flying Time, something about homebuilders?

- **Major Mechanical Issues:**
  - Almost all "Aircraft" related accidents are engine/fuel system related – maintaining a reliable engine installation is critical
  - Forward Hinge Canopy – have lost canard aircraft due to canopy opening upon takeoff and prop fouling – **FLY THE PLANE** (**FHC** does prevent bailing out, but who flies with a parachute?) FHC fixes a pilot error with design
  - Fuel contamination – follow Al Wick's tank cleaning methodology (and don't route hydraulic lines [or anything else] through gas tank)
  - Nose Oil Seal retainer – many instances of oil loss due to seal loss
  - Non-aircraft rated fittings/lines – "Walrus" custom canard aircraft burned June, 2010
  - Glenn Saunders' VE accident – plastic fittings in fuel system

- **Potential Issues:**
  - Roll bar – have been rollovers, hard to determine whether roll-bar would have helped
  - Control System play – torque tube mounts / bolted joints – flutter susceptibility and loss of control
  - Other?

Futures / State of Design

- **Future of COZY:**
  - Very active community: plans sales still ~20-40/year (per Jim Irwin)
  - New completions all the time
  - Slow evolution of derivatives
    - Chris Esselstyn's stretched retract
    - FHC popularity
    - Other O-540 variants
    - Wider fuselages, etc.

- **State of Design Questions:**
  - Extremely well developed design/plans – however…
  - Official Builder Support – how well is this working?
  - Official Designer (qualifications)?
  - Who Approves Vendors/Parts?
  - Who Approves Modifications/Design Changes/Fixes?
  - How is Design Advancing?
    - Fits and starts
    - Randomly
    - Little good testing of mods, per Nat's example

- **MANY non-engineered mods occurring – <u>VERY</u> worrisome to me**

Questions? (& Answers)

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- My Phone: (978) 502-5251

- Website: http://www.cozybuilders.org/

- Icon is hiring engineers! Talk to me / send resume' if interested