COZY AIRCRAFT FORUM

Soup to Nuts?

Marc J. Zeitlin

August 1st, 2008

1:00 PM – 2:15 PM

Forum Tent 02 – GAMA Pavilion

What Will I Talk About?

- ***Introduction***

- ***Who Am I?***
- ***What's a COZY MKIV?***
- ***Thanks Nat!***
- ***Aircraft Spruce – Plans***
- ***Why a COZY MKIV (canard)***
- ***Safety Record***
- ***Cost***
- ***Support***
- ***How Many COZY's Under Construction / Flying?***

- ***Brock Replacement Parts Vendors***
- ***My Building Experience(s)***
- ***Techniques/Tips/Tricks***

- ***Trip Examples***
- ***Airport Examples***

- ***By Request:***
  - ***Aircraft Structure***
  - ***Required Homebuilt Inspections***
  - ***Flight Testing / CG positioning / W&B Issues***
  - ***Alternative Engines***
  - ***Common Modifications***
    - ***Approved***
    - ***Not Approved***
    - ***Not Acceptable***
  - ***Performance / Efficiency Mods***

- ***Futures / Conclusions***
- ***Questions and Answers***

Who The Heck Am I?

- Biography / Resume'
  - http://www.mdzeitlin.com/Marc/bio.html
- Built Quickie Q2
- Built COZY MKIV #386, N83MZ – ~620 flying hours
- Started / Administer Unofficial COZY Builders Web Page and COZY Mailing List
- Work for Scaled Composites as Mechanical Engineer – Currently Project Engineer for SS2 Rocket Motor Development

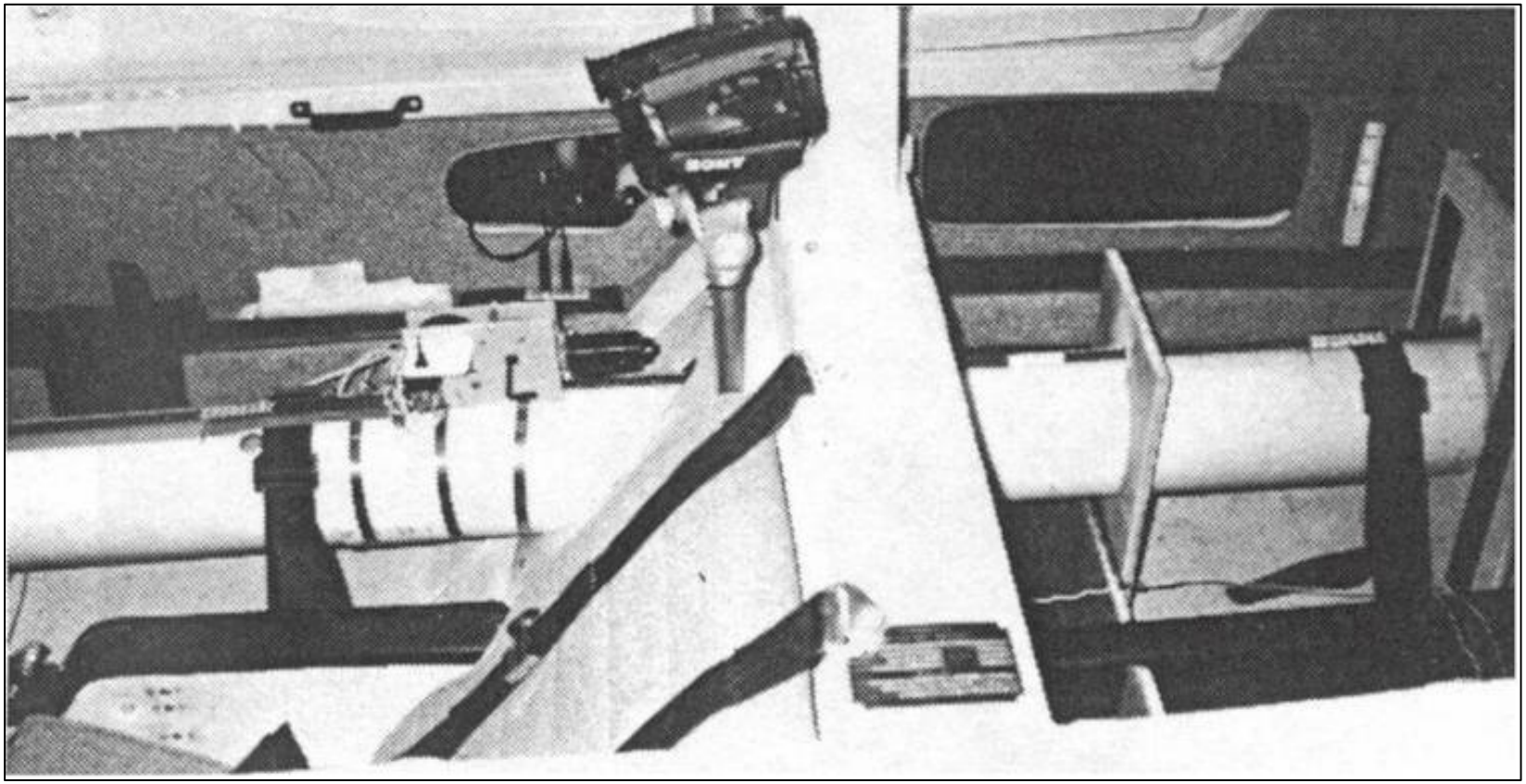
What's a COZY MKIV?

- History
  - Derivative of Burt Rutan's Long-EZ
  - Evolved from 3-place to current 4-place in early 1990's
- Type
  - Canard – big wing in back, small wing in front
  - 4 place, or 2+2, or 2 + LOTS of baggage
  - Efficient, fast, long distance cruiser
- Aerodynamics – Nat's 2005 Oshkosh Forum
  - http://www.cozybuilders.org/Oshkosh_Presentations/Nats_OSH2005_Presentation.pdf

Nat and Shirley Puffer

- Designer
- Retired
- Building/ Flying Jabiru

Nat's Rear C.G. Testing Apparatus



Aircraft Spruce - Plans

- Cozyaircraft Corp. now owned by ACS
- Plans available through ACS

Why a COZY MKIV?

- Want to **BUILD**
- Use-Model comparison
- Economics
- Carrying Capacity
- Safety Features
- Composites

COZY Safety Record

- NO accidents caused by structural/aerodynamic failure of properly built and flown COZY aircraft – in fact, of **ANY RUTAN/DERIVATIVE CANARD**
- Since 1989, 20 total accidents - 13 reported accidents in USA, 1 in Canada, 1 in Mexico, 3 in France, 2 in South Africa

- **7 Fatal Accidents**
  - **Phase I**
    - COZY MKIV - poor approach and hard landing (1994 - N151JE)
    - COZY MKIV (turbine) - 1 Unknown cause – crash into water (2008 - N14GG)
  - **Phase II**
    - COZY MKIV - low approach snagging wires (1995 - N5037)
    - COZY III – suspected prop fouling / open canopy in France (2001 – builder - Soria)
    - COZY MKIV - severe wind shear in Mexico (2002 - N41CZ)
    - COZY Classic <improper build / CG problems?> in France (2004 - F-PSCF)
    - AeroCanard - takeoff problem / possible prop fouling from open canopy (2007 – N199JW)

- **13 Non-Fatal Accidents**
  - 1 fuel exhaustion
  - 1 GU canard contamination / CG related
  - 1 CG related deep stall
  - 4 engine failure / fuel system failure
  - 3 poor approach / landing
  - 1 rudder flutter (improper build) in France (2004)
  - 1 overtightened bolts and/or wheel pant tangled in wheel in South Africa
  - 1 poor takeoff / no rotation in South Africa

Accident **RATE** – **Assume** 105 flying (avg.), 50 hrs/yr (avg.), 17 years – 89K hrs total

- **7.9/100K** hrs **fatal** (5.6/100K w/o Phase I)
- **22/100K** hrs total
- GA is **1.26/100K** hrs
- GA is **6.32/100K** hrs

COZY MKIV Cost

- Low End - $25K to $40K
  - High Time Engine (maybe Auto Conversion)
  - Good Scrounging
  - Minimum Instruments - VFR Only
- Mid-Range - $40K 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!!!

Support Methods

No Official Support from ACS, but:

- COZY Newsletter archives
  - http://www.cozybuilders.org/newsletters/
- COZY Mailing List
  - http://www.cozybuilders.org/mail_list/
- Unofficial COZY Builders Web Page
  - http://www.cozybuilders.org/
- Builder's Web Pages (links from **UCBWP**)
- Canard Aviator's Mailing List
  - http://groups.yahoo.com/group/canard-aviators/
- CSA Newsletter
  - http://www.cozybuilders.org/ref_info/other_news.html
- Freeflight Composites (Burrall Sanders)
  - http://www.freeflightcomposites.com/services.htm

If you're a prospective builder and believe that official support from a sanctioned ACS/Nat Puffer avenue would help convince you to build this plane, let Jim Irwin at ACS know.

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)
- ~ 220 - 300 flying COZY's all over the globe
- ~1600 COZY MKIV plans sold
- ~ 600-800 actually under construction
- 5-10 new COZY MKIV first flights per year

Brock Replacement Parts

- Brock MFG closed 1/1/2006 – sole MFG of metal parts for COZY / Rutan canards
- Two main vendors took over MFG of parts:
  - CG Products
    - http://www.cozygirrrl.com/aircraftparts.htm
  - EZ Noselift
    - http://www.eznoselift.com/
- Other part vendors as well have taken up some slack – see:
    - http://www.cozybuilders.org/newsletters/suppliers.html
    - http://www.cozybuilders.org/newsletters/na_suppliers.html

My Building Experiences

- Quickie Q2 in a warehouse
- COZY MKIV in a small basement (seen here)
- COZY MKIV in a 2-car garage (most common)
- Other Folks Experiences similar

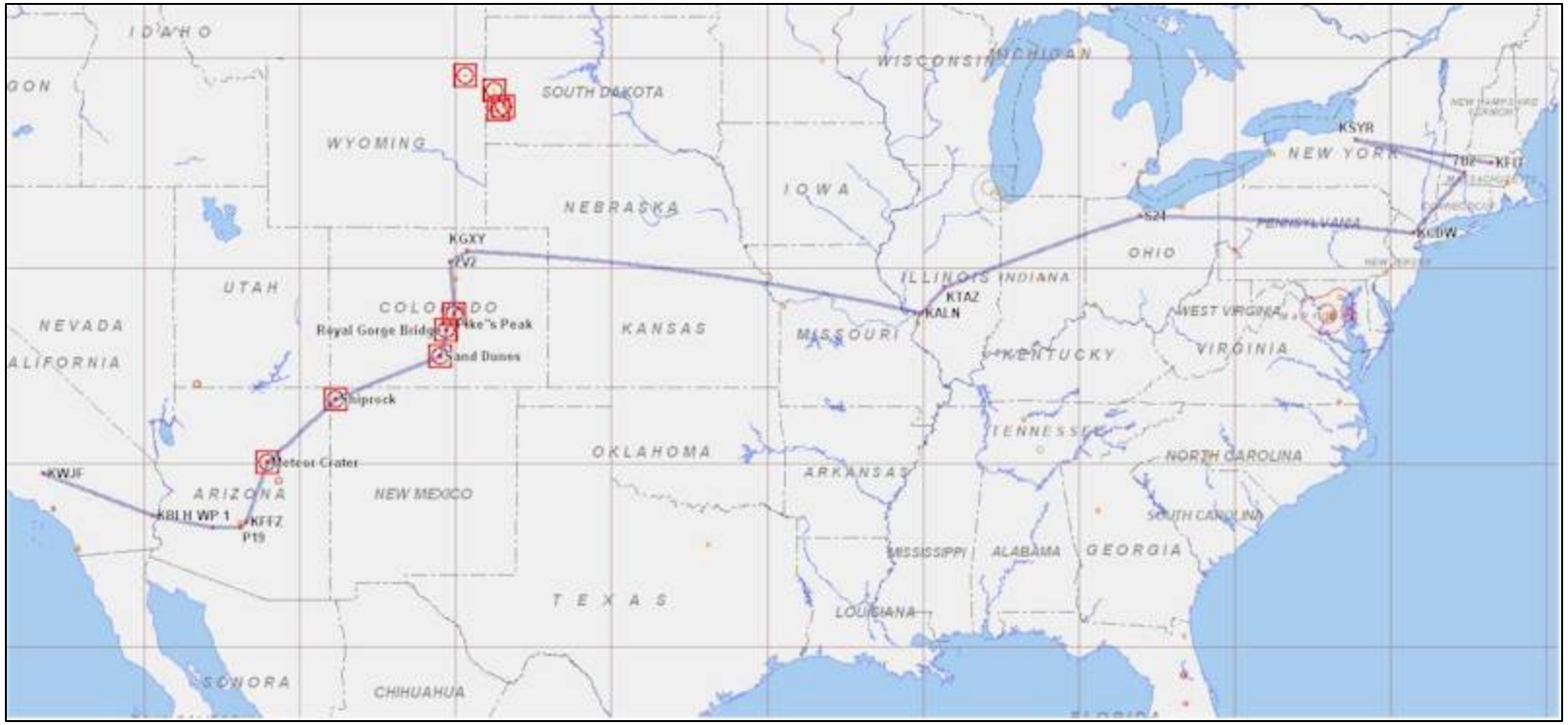
Techniques, Tips, Tricks

- Layups
  - Vacuum bagging
  - “Low-vac” bagging
  - Peelply/plastic squeegeeing
  - Hair dryers / warmth
- Finishing
  - “Cory Bird” method
  - LOTS of micro: one pass

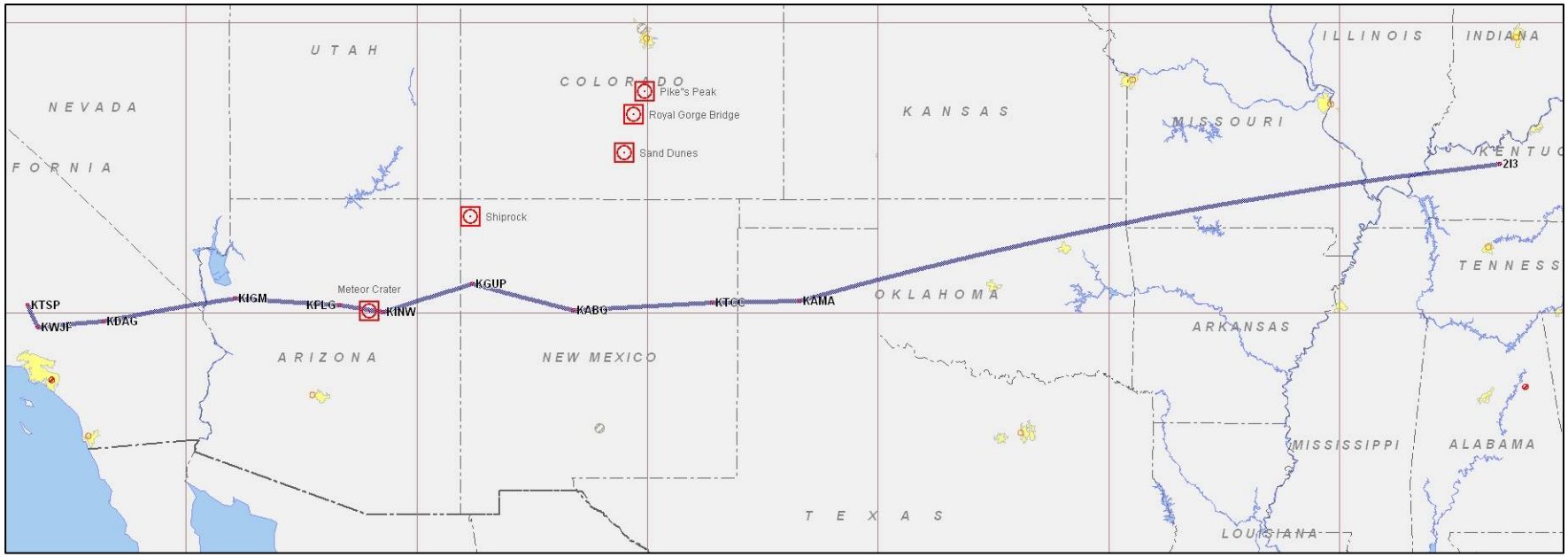
- See FAQ and folks web pages – LOTS of ideas

Move to California - Visits

August 25th, 2005 – September 1st, 2005



KTSP – 2I3



Tehachapi to Rough River – September, 2007

Range Of Airports – LAS

Range Of Airports - AFN

Aircraft Structure

- 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** is on V.E. canard – failed at 14G
  - At least one L.E. wing test done – no details known
  - NO COZY structural testing has **ever** been done!!!

- 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

USA Required Inspections

- Op-Limits will require Annual "Condition Inspection"
  - Similar to "Annual" for certificated aircraft – within 12 months
  - Need A&P (**NOT** IA) or Repairman's Certificate (for aircraft)
  - Must be "in accordance with scope and detail of " Part 43 Appendix D

- Pitot/Static/Transponder Check (91.205, 91.411, 91.413)
- ELT Check (91.207)
- VOR / NAV check (91.171 - 30 days)

Flight Testing / W&B

- Flight Test Guidelines
  - See **AC90-89A – EXCELLENT** guide
  - Use a Test Pilot if not completely capable and current
  - Flying around in circles for 40 hours at one CG is **NOT** flight testing

- CG Determination
  - Need **ACCURATE** empty CG – implies accurate weighing
  - Bathroom scales are **NOT** accurate enough
  - Can weight with ballast / passengers / pilot for more accurate station information
  - Use accurate spreadsheet / calculations to determine flight CG
  - Use weights (lead, steel, sandbag, water container) at appropriate station to set CG for testing

- W&B Issues
  - Start testing in **CENTER** of CG range
  - Slowly add weight and move forward and aft within CG range
  - Test for:
    - Rotation, climb, stall, accelerated stall, deep stall susceptibility, pitch stability

COZY Alternative Engines

FLYING:

- Subaru -
  - Two flying (different variants) successfully
- Twin Suzuki -
  - One flying successfully
- Rotary (Mazda 13B variants) -
  - Two "flying" – very little flight time, numerous engine related incidents
  - Two others removed for Lycomings after minimal flight time
- V8 variants -
  - One flying in South Africa (few hours due to accident – not engine related)
  - One removed long ago and replaced with Lycoming
- Turbo-prop -
  - One flew – crashed during Phase I recently (cause unknown)
- Jet Turbine -
  - One flying successfully
- Jabiru 5100
  - One flying successfully
- Lycoming O-540
  - Two flying successfully

IN DEVELOPMENT:

- One Continental IO-360
- Numerous Mazda 13B and 20B variants

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:
  - Remove Lower Winglets (mandatory to have on COZY!)
  - Raised Canopy (approved)
  - Widened (Aerocanard “style”) Canopy
  - Forward Opening Canopy, a-la Cosy Classic
  - Long-Eze type (“Cozygirrrl”) strake L.E.
  - Original Length Canard (mandatory to cut 6” from original – possible safety issue with rear CG, & rotation, but numerous flying)
  - Retractable Main Gear (not recommended, but there are a few flying)
- Minor:
  - Electric Nose Gear (approved)
  - Electric Landing Brake (approved)
  - Move Landing Lights
  - Hanging Rudder Pedals (Velocity Style)
  - Eliminate Fuselage Access Door
  - Etc., etc., etc.

Performance Modifications

- Wheel Pants (size / design) - 8 to 12 kts
- Gear Leg Fairings - 3 to 7 kts
- Cowling/Cooling (airflow / boat-tail / exhaust) - 0 to 15 kts potential
- Nose Wheel Door - ?? (small)
- Winglet Intersection Fairings - 1 to 4 kts (est.)
- Spinner - 0 to 1 kts

- Appropriate VG's
  - Decrease landing speed - 7 to 10 kts
  - Decrease top end speed - 1 to 3 kts

Futures / Conclusions

- Future of COZY
  - Very Active – plans sales dropped but still strong ~50/year
  - New completions all the time
  - Slow evolution of derivatives beginning

- Great Plane!
- Great People!
- Great COZY/Canard Community!
- Great Capabilities!

- Is This What **YOU** Want?

Questions? (& Answers)

- My Email: marc_zeitlin@alum.mit.edu
- Website: http://www.cozybuilders.org/

- For Sale?
- (Training???)
- (Planes out on line for pictures???)
- (Summary of tips/tricks –FAQ / builder's web sites)
- (Builders Websites)
- (Digital Camera – documentation)
- (Composite Workshops – here/OSH)
- (1st Flights/Testing)
- (Interested folks list – names/email addresses)