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# The Ultimate Do-It-Yourself Project: Building the Early Bird Jenny



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Jul 12, 2016



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## Topics

- Background
- Getting Started
- Early Days - Building Wings
- Key Challenges
  - Engine Mount
  - Exhaust
  - Intake & Cooling
  - Fuel & Electrical
- Instrument panels
- Getting the Special Airworthiness Certificate
- Getting through the first flight
- Lessons Learned



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## What is an Early Bird Jenny?

- Open cockpit biplane which qualifies as Light Sport
- 2/3 scale look-alike of a Curtiss JN-4D “Jenny” popular as WWI trainer and barnstormer in 1920’s
- Designed by Dennis Wiley in 1987
- Sold as plans – 3 sheets of drawings and 40 pg of notes
- Uses modern construction techniques and fabric covering
- FAA Registry shows 26 licensed
  - I have personally
    - Seen two at Oshkosh in 1998
    - Seen two in southern Ohio
    - Flown one near Cincinnati
    - Seen one in Chino, CA



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## Specifications

- Engine is 3 cyl Suzuki from 1992 Geo Metro
- Wing span = 27.5 ft, Length = 18.3 ft, Height = 7 ft
- Gross weight = 950 pounds, empty weight = 550 lb
  - Wing area 175 sq ft with wing loading 5.1 lb/ft<sup>2</sup>
  - 65 HP gives power loading of 13.8 lb/HP
- Cruise speed = 60-70 mph on 3 gph
  - $V_s = 35$  mph,  $V_x = 45$  mph,  $V_y = 50$  mph,  $V_{ne} = 80$  mph
- Takeoff roll = 250 ft and Landing roll = 300 ft
- Qualifies for Light Sport Pilot





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## Getting Started

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- I did not start by deciding to buy/build an airplane
- A friend provided a welded tube fuselage and engine as a starting point for a project at the local chapter of the Experimental Aircraft Association (EAA)
- I joined the team (April 2002) and after I became addicted, the others went away
- The project provided an opportunity for kids to learn by helping build
- Primary goal is to provide Young Eagles rides

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## Start with a building space

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## Early days – building wings

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It is good to have help

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## Pay-off from a good table

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Wings are square to within  $1/16''$

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## Major milestone on 7/21/07

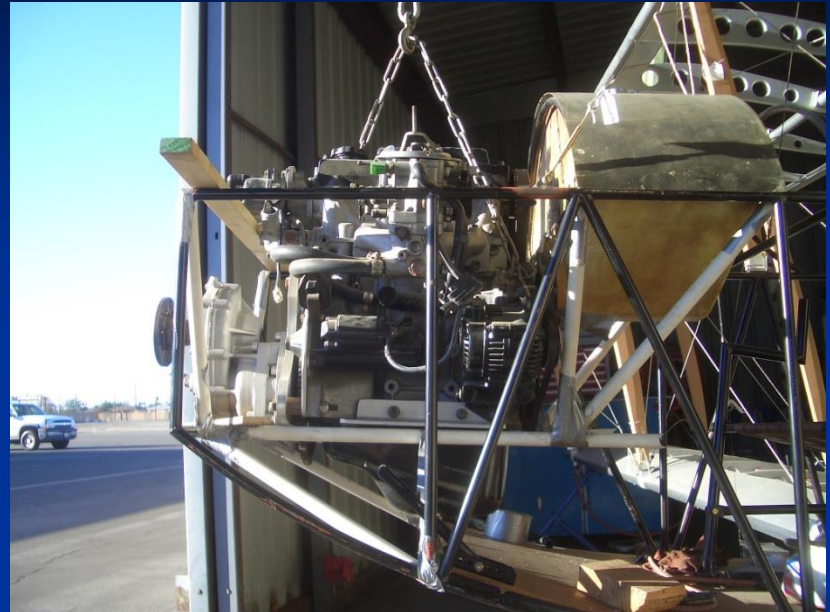
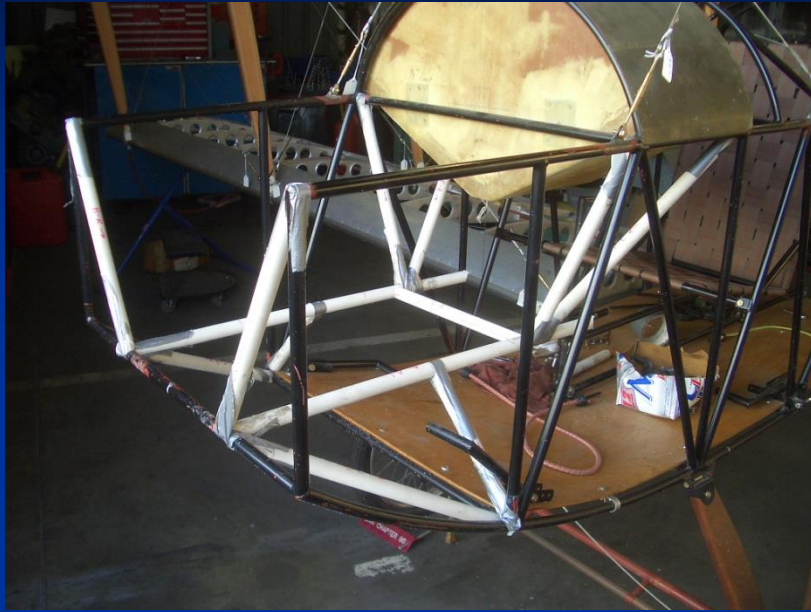




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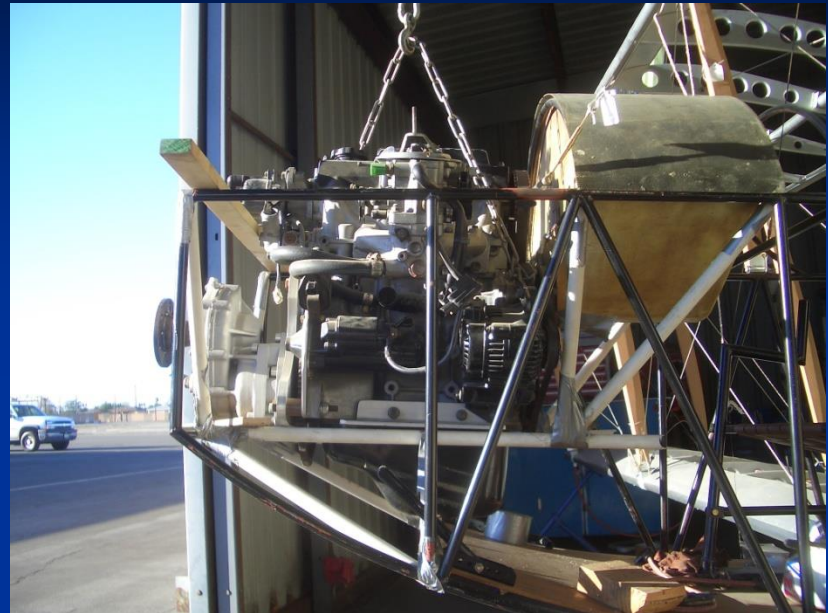
## Key Challenges – Engine Mount

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## Key Challenges – Engine Mount





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## Key Challenges – Engine Mount

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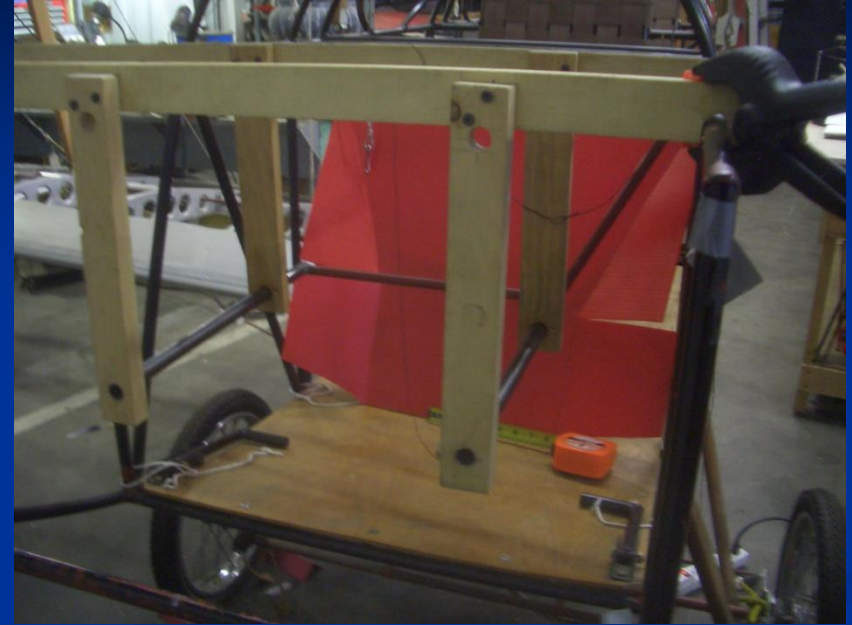
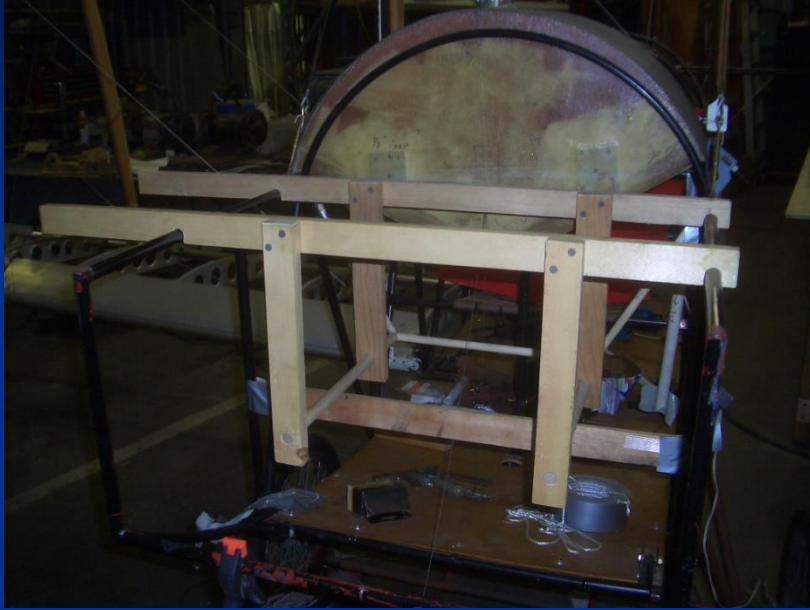




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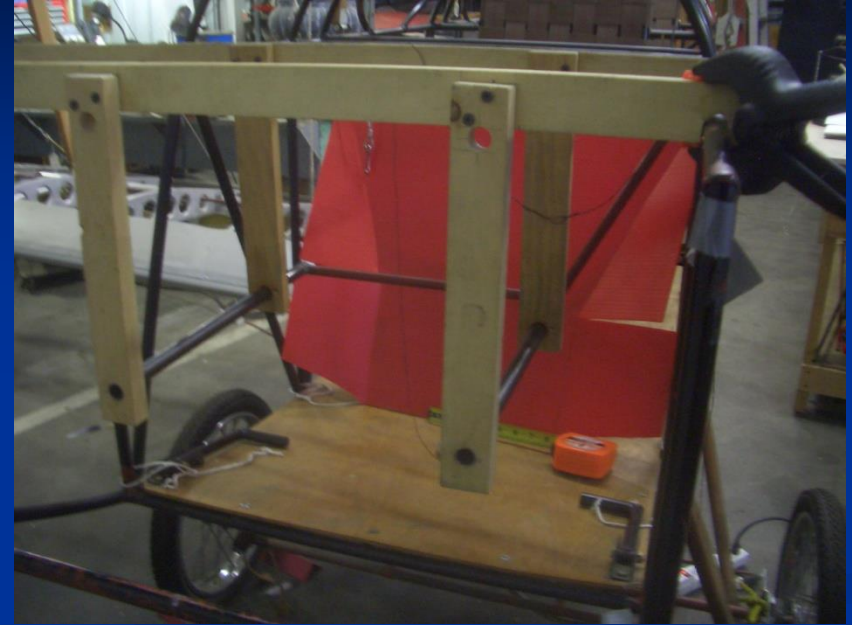
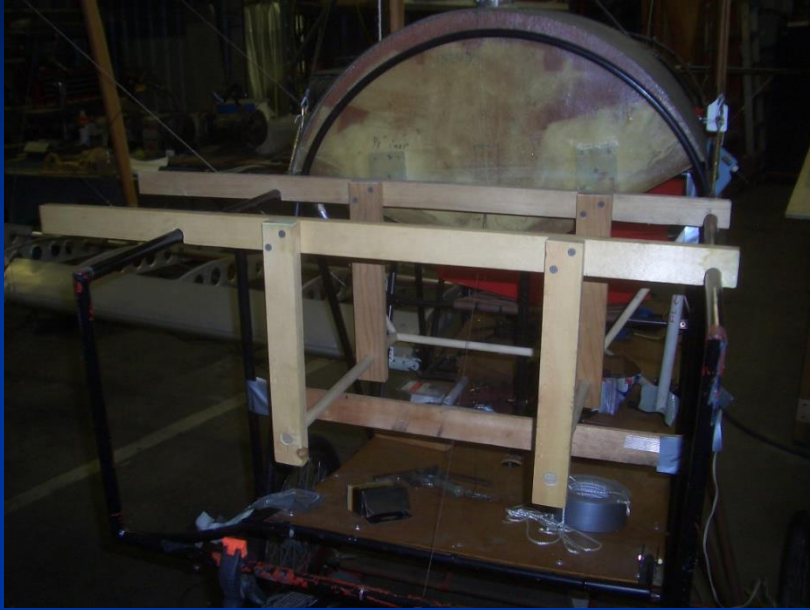
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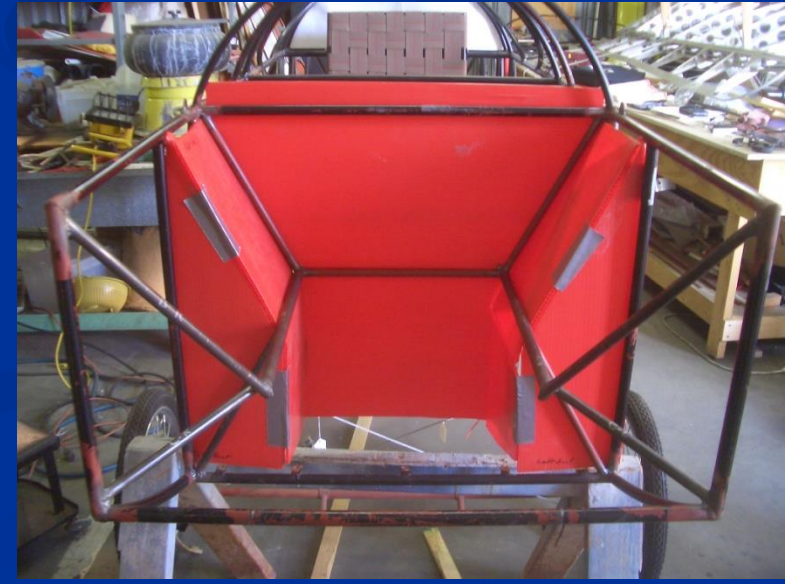
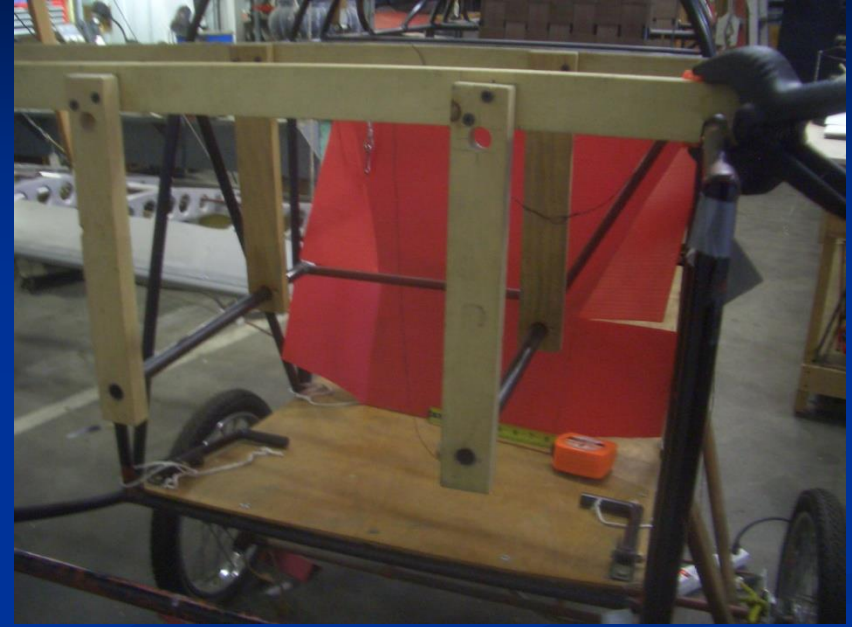
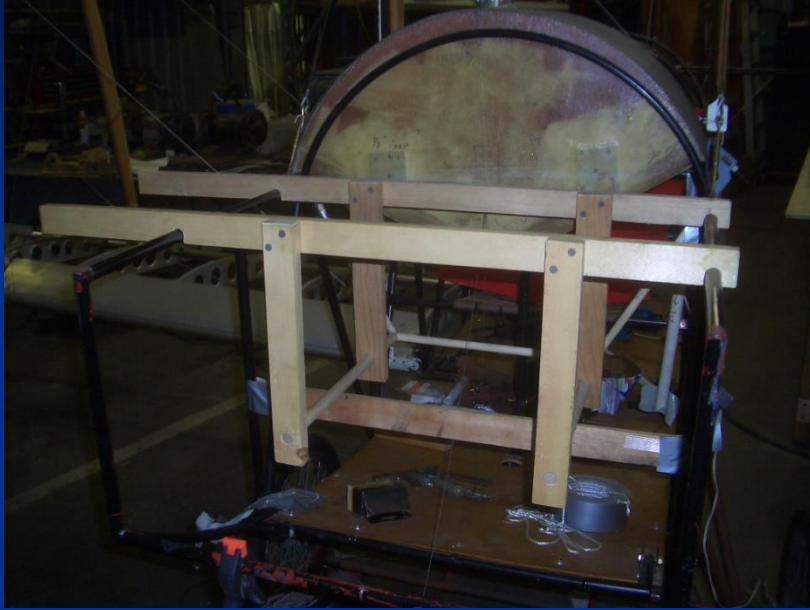
## Key Challenges – Engine Mount





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## Key Challenges – Engine Mount



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## Key Challenges – Exhaust





# Key Challenges – Intake & Cooling

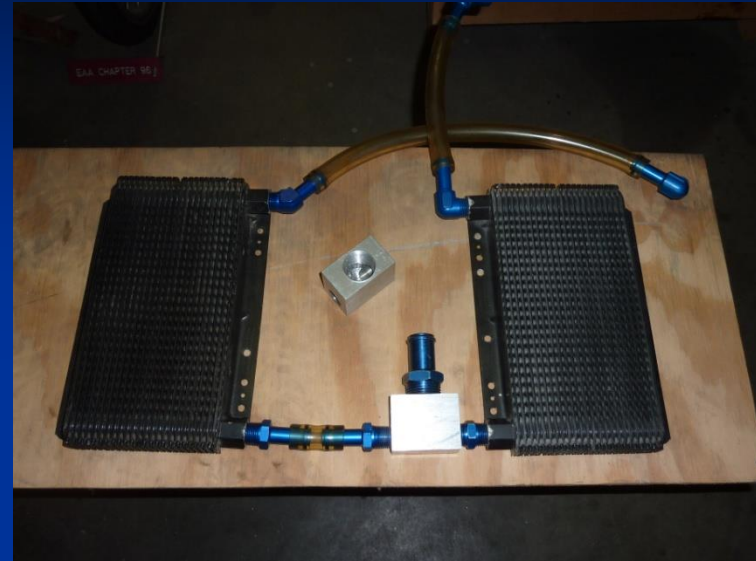
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## Key Challenges – Intake & Cooling

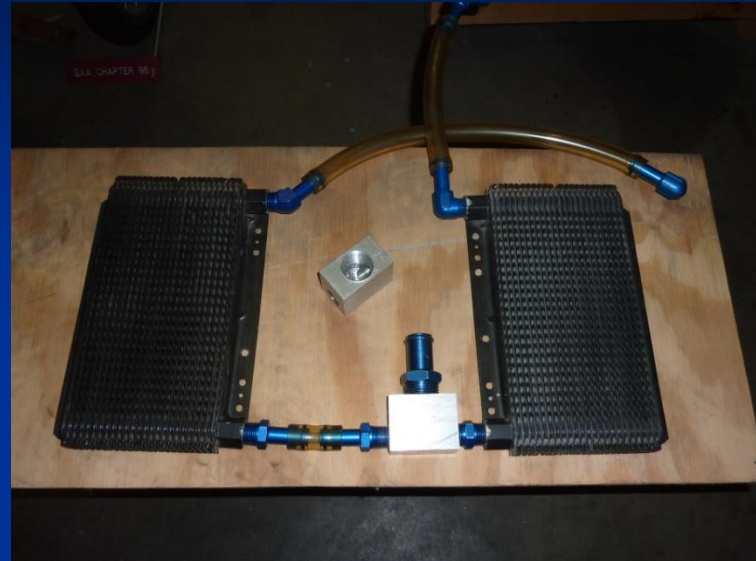
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## Key Challenges – Intake & Cooling



# Key Challenges – Fuel & Electrical

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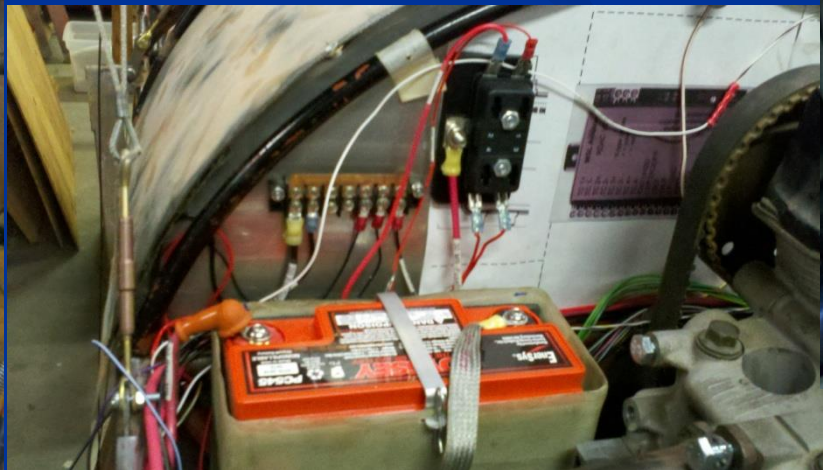
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## Key Challenges – Fuel & Electrical

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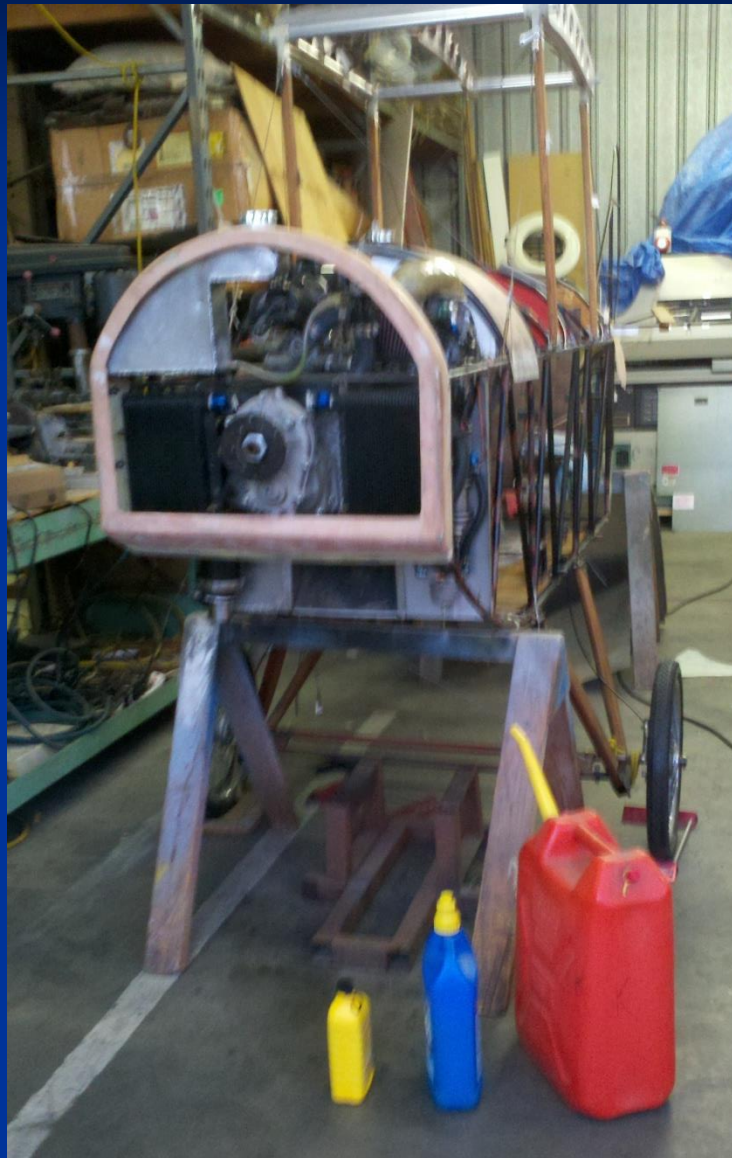
# Key Challenges – Fuel & Electrical





# Major Milestone – First Engine Run

8/11/12



# Major Milestone – First Taxi 12/8/12



[First Taxi Video](#)



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## Front Instrument Panel



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## Rear Instrument Panel

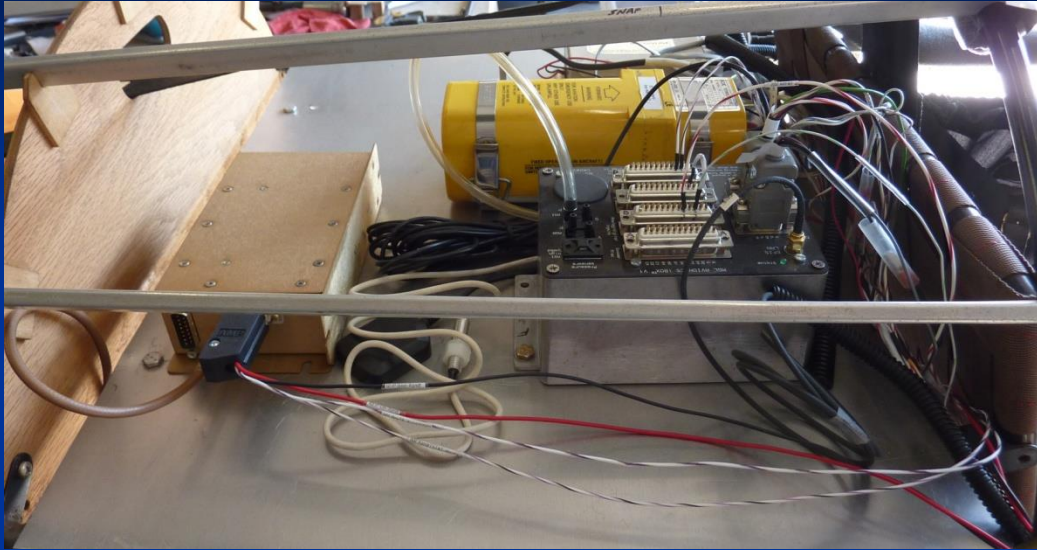


- MGL V-10 VHF Comm
- MGL Explorer EFIS

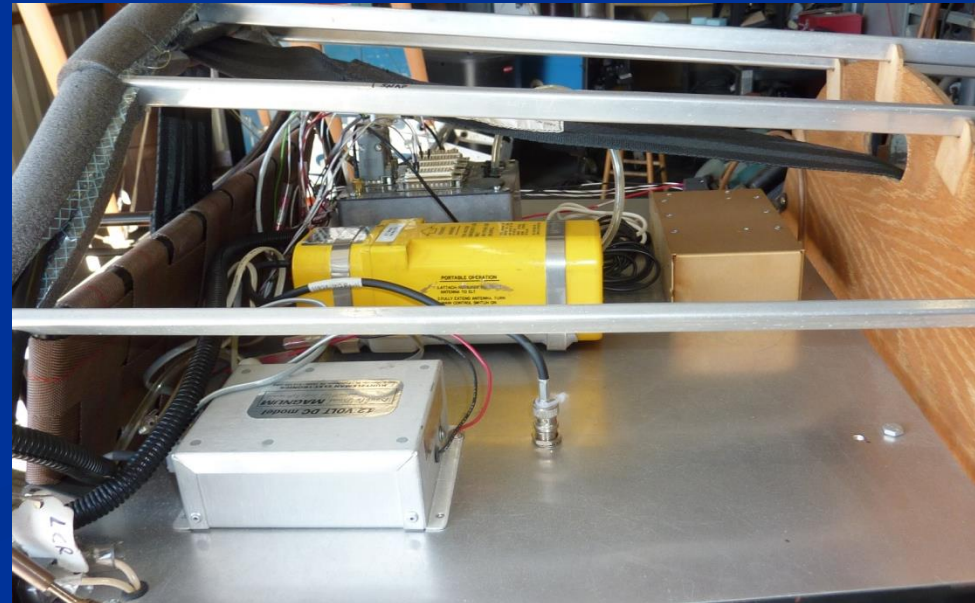


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## Rear avionics deck



- MGL iBox
- ACK E-04 ELT
- Sandia STX165 Transponder
- Kuntzelman Dual Magnum Strobe

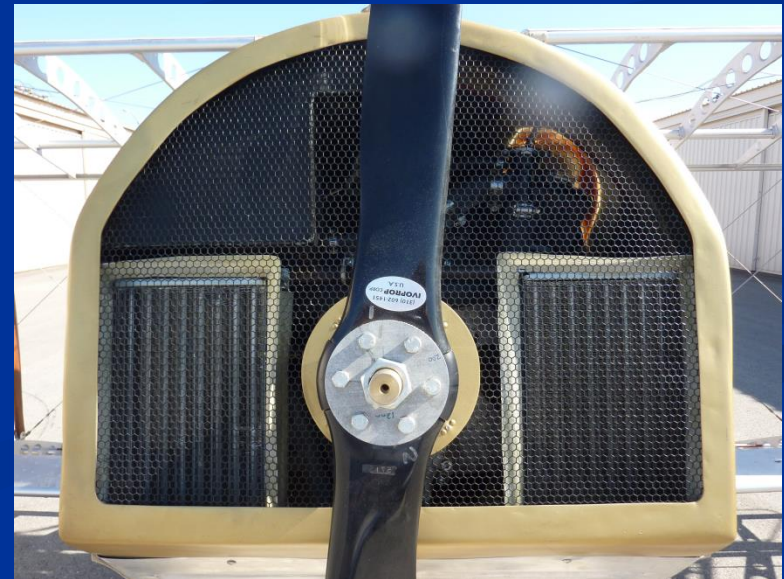
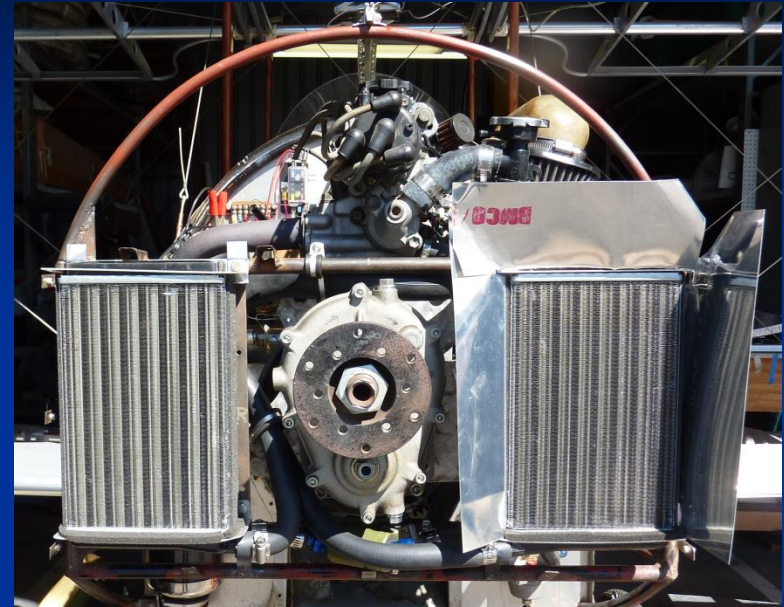


# Key Challenges – Improved Cooling





# Key Challenges – Improved Cooling



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Fully functional 7/2/14





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## Next Steps after 7/2/14

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- ✓ Cover tail feathers and thrust test
- ✓ Tag all parts and fully disassemble
- ✓ Clean and prime everything metal
- ✓ Build new wood floorboard and panels
- ✓ Cover with fabric (Superflite & Stewart System)
- ✓ Paint cowling
- ✓ Reassemble with
- ✓     aviation fasteners
- ✓ Taxi Test
- ✓ Move to Chino
- ✓ First Flight



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Next step was - backwards





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## Fuselage prep – Blast & Prime



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## Fuselage prep - Degauss





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## Reassemble – Floorboard, controls, landing gear



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## Beginning to Cover the Fuselage

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## Superflite Fabric on the Fuselage

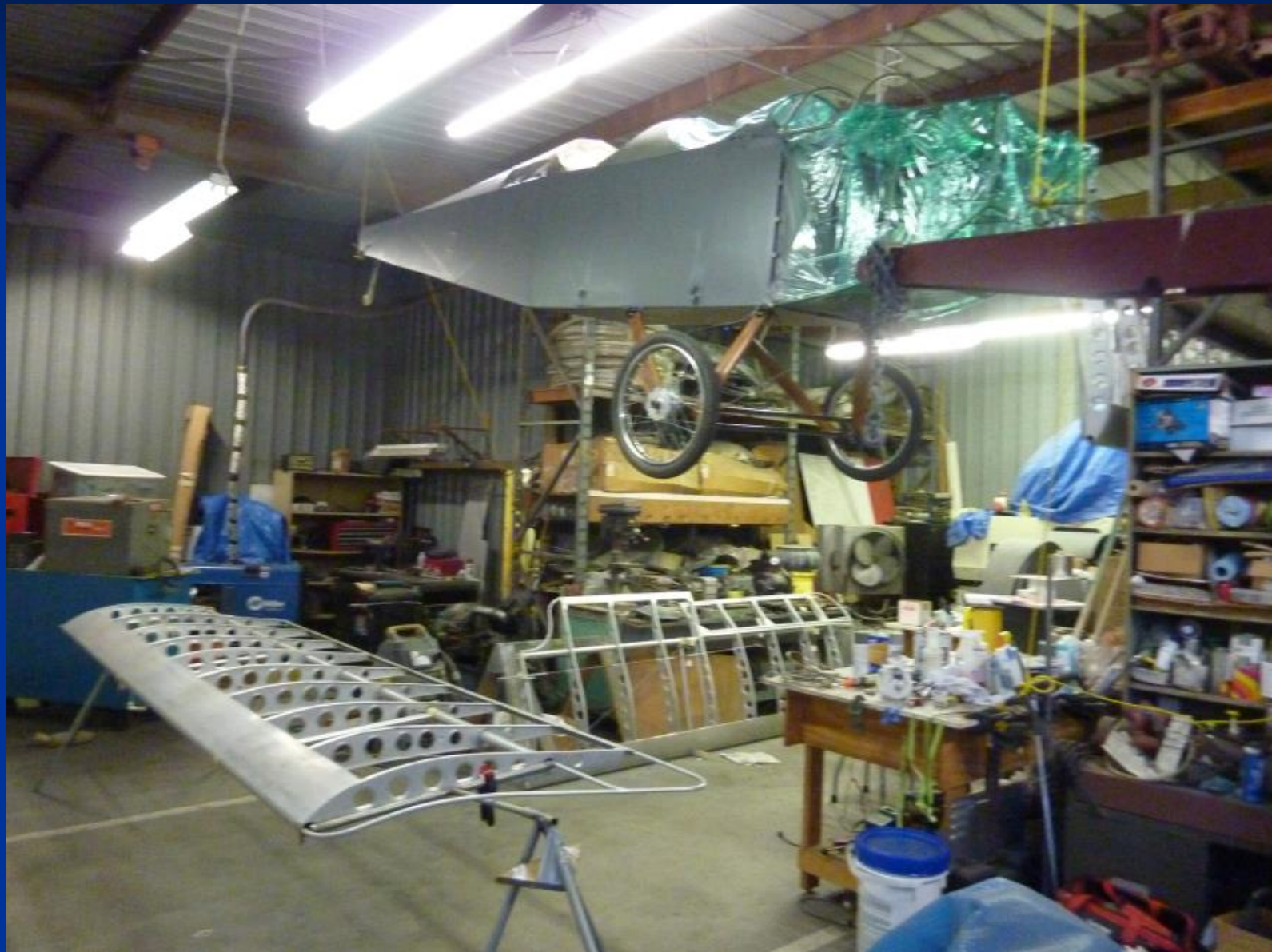
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## Fuselage up, First Wing Ready

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## Covering a Wing x4

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## Rib supports, anti-chafe

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## Iron 3 passes, rib lacing

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## Finishing tapes and doilies

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# Primer - Brushed + 2 sprayed crosscoats

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**Final prime with sprayed white coat**





# Final coats with Yellow



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## Priming the Fuselage

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**Final coat of olive drab**



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## Ceramic coating for exhaust

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## Other Painting and Finishing

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## Finally - reassembly

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## Finally - reassembly

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First time in the sun





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## Last taxi at CPM



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## Registration & Certification Process

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- Use EAA “Step by Step Certification Guide” and FAA AC20-27G
- Get Registered with FAA:
  - Reserve number N1915J (\$10/yr)
  - Submit AC8050-1 Aircraft Registration Application & \$5.00
  - Submit AC8050-88 Affidavit of Ownership (notarized)
  - Receive AC8050-3 Certificate of Aircraft Registration
- Pick flight test airport
  - Determine flight test area – negotiable with FAA office
- Find DAR (Designated Airworthiness Representative)
  - Provides FAA required inspection and sign-off



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## Working with the DAR

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- More paperwork:
  - Pictures of the completed aircraft as it is ready for inspection, including a close up picture of the data plate.
  - Copy of the aircraft 3-view drawing.
  - Copy of Weight and Balance calculations
  - Draft AC 8130-6 (Application for Airworthiness Certificate),
  - Program Letter
- Inspection date set for Dec 18, 2015
  - I now have a deadline



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## Moving to Chino (KCNO)

- Scramble for hangar space
- All dressed up and no place to go
- Inspection deadline looming
- Leave for KCNO Monday morning without a hangar
- Received call as  
I arrived at CNO





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## Best space available at Chino

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## Moving in to new home

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## New biplane concept



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## More likely to pass inspection

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## Put into perspective



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## The Big Day

- For day of inspection, provided:
  - Draft of Operating Limitations.
  - Fuel flow check
  - Completed Fabrication Checklist
  - AC 8130-12 Eligibility Statement Amateur-Built Aircraft (notarized)
  - Pictorial evidence of building
- DAR with help from FAA
- After DAR inspection
  - Receive copy of signed AC8130-6
  - Receive signed AC8130-7 Special Airworthiness Certificate
- Taxi around airport perimeter





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## First Flight Prep

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- Flight test planning
  - AC 90-89A AMATEUR-BUILT AIRCRAFT AND ULTRALIGHT FLIGHT TESTING HANDBOOK
  - Aircraft Checklists
  - Flight Test Plans
- Pilot prep
  - Refresher of spins and recovery from inverted flight
  - iEFIS practice in SLING
  - Tail wheel refresher in Stinson and Citabria
- Flight Advisors – Jim, Dave, and John
- Picking a date - Very weather dependent
  - Goal was first flight on 100<sup>th</sup> anniversary of Curtiss Jenny

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## First Flight

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- Dec 30, 2015 – Clear with light winds
  - Taxi warm up
  - High speed taxi with tail lift
  - Four bunny hops
  - Normal (?) takeoff, three circuits, gentle landing
- Planned Data collection:
  - Pictures by ground crew
  - Garmin VIRB camera: Video, audio, GPS
  - iEFIS: GPS and all flight/engine parameters



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## Engine starts – ready to go ! (?)





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**Cleared for Take-off**

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Jenny can fly!

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## Surprisingly Gentle Landing

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## Flight Profile

Duration: 18 minutes  
Max Altitude: 2047 ft  
Max speed: 68 mph  
Min speed: 38 mph  
Distance: 14.9 miles

Liftoff: ~44 mph  
Touchdown ~44 mph

Biggest problem:  
Air noise in  
microphone



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## Progress Since First Flight

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- Oil pressure low ??
- Fuel vaporization after shutdown
- Fixed oil leak
- Cooling issues:
  - Okay first two flights (Outside Air Temp 55°F)
  - Third flight engine overheated (OAT 70°F)
  - Numerous improvements made, but OAT keeps increasing
    - Added fans behind radiators
    - Replaced antifreeze with water, changed radiator cap
    - Replaced water pump
    - Replaced tees
- Added color flash to rudder



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## Remaining Tasks

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- Leather cockpit trim and covers
- Leather cowling straps
- Cockpit head boards
- Wood instrument panels
- New windshields
- Replace center section cover
- Paint touchup
- Roundels on wings
- Fuselage lettering

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## Technologies Used

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- Fuselage – welded 4130 steel tubing
- Wings – riveted aluminum internally
  - Spars - 6061 T6 Aluminum ,
  - Leading/trailing edges – 3003 H-14 Aluminum
  - Misc – 6063 T-52, 2024T6
- Fabric covering – Superflite fabric & Stewart Systems (Ekobond, Ekofill, EkoPrime & EkoPoly paint)
- Struts – Douglas fir (stair tread)
- Cowling - 5052 Aluminum & Fiberglass
- Cockpit trim – leather & foam
- Instrument Panel
  - Front - classic round dials
  - Rear – State of the art EFIS
- Labor – 4700 hr thus far (plans say 400 hr)



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## Overall effort – nearly 14 years

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<u>Area</u>	<u>Days Logged</u>	<u>Hours</u>
Plan/Org	76	277
Fuselage	248	872
Tail	29	118
Wing	188	795
Engine	255	958
Cockpit	41	151
Electrical	60	291
Instruments	53	204
Covering	162	685
Perf Analysis	7	31
Final Assembly	43	274
Flight Test	10	44
Grand Total	1173	4707

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## Costs thus far

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- Prior expenses - ??
- Donated parts - ??
- Direct parts and material - \$15K
- Hangar space - \$14K
- Prior hangar space - ??
- Supplies, tools, and various expenses - \$6K



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## Lessons Learned

- Use a really good table to build the wings
- Expect to make prototypes
- Making good parts requires good jigs
- Building is addictive
- Even when you think that you are done, a deadline is hard to meet
- After the first flight, you are still not done
- Cooling is always a challenge
- First flight airplane already has hangar rash
- You will need to learn many new skills
- It is a good excuse to buy tools



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## Thank You

## Questions?



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