Inspecting and Maintaining the Lancair Legacy

General description and model-specific areas of interest

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Overview

• Basic Airframe and Systems
• Prepurchase Inspection
• Service Bulletins & Known Issues
Basic Airframe and Systems

- Structural Components
- Flight Controls
- Motor Mount and Nose Gear
- Fuel System
- Hydraulic System
Characteristics of Composites

• No corrosion, infinite fatigue life
• Failure modes
  – Failure of bonded joints
  – Delamination
  – Damage from impact or overstress
• If built correctly and not abused, these airframes can last indefinitely!
• Steel and aluminum parts are still subject to normal wear and corrosion
Airframe Assembly

• Premolded parts and subassemblies are built under factory controlled conditions in the Philippines

• Optional factory assist program
  – Close the outer wings and empennage
  – Marry the center wing section to the fuselage
  – Install the horizontal stabilizer
  – Assemble the canopy
  – Optional firewall forward and instrument panel packages
H. Premolded Parts - Exploded View

Legend:

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Fuselage

- Carbon fiber monocoque construction
- Reinforcement bulkheads
  - Firewall
  - Seat back
  - Baggage bulkhead
  - Empennage
Fuselage Internal Components

- Seat back rail and canopy bow provide rollover protection – Do not compromise these structures!
- Engine mounts, nose gear tunnel, front floorboards come preassembled with firewall
Center Wing Section

- 10’ wide, consists of front & rear spars, bottom wing skin, hardware attach points
- Mounting structure for multiple systems
- Forms cockpit floor or ‘belly pan’
Center Wing Installation

• Belly pan skin is bonded to fuselage just behind seat back and ahead of main spar
Center Wing Installation (cont’d)

- Load pads connect the wing to the fuselage sides
- This is what holds the plane together!
Bonding

• Proper surface preparation is critical
• Surfaces should be joined within a few hours of sanding
• Epoxy-flox is very strong but inflexible
  – 30 minute working time, $84/gal
• Hysol remains somewhat flexible after curing
  – 3 hour working time, $150/qt
N103LL Structural Failure

• Completed in 2003 with Factory Assist
• Inboard Wing Panel Departed in Flight 9/2004
• Pilot made a hard landing resulting in nose gear separation and a prop strike
• Large crack at wing-fuselage joint
• Adhesive does not cover full width of bonding surface
• Large voids in the epoxy, shiny appearance

epoxy/flox closeup
Part of main spar and inboard joggle
Proper Bonding Procedure

• Wing stub skin after sanding and wetting with Hysol
Proper Bonding Procedure (cont’d)

- Joining surface wetted with Hysol/flox mix
- Stub skin is installed late in the project to maintain access to wheel well area
Curing

- Weight must be applied in the correct areas to ensure good contact
Verifying Bond Quality

- Look for generous squeeze-out over the entire length of the bond
- Manually retracting the main gear leg can allow better access to hard-to-see areas
Verifying Bond Quality (cont’d)

• Use all available access panels to see as much of the bond as possible
• Use an inspection mirror and/or borescope to see remote areas
Flight Controls

- Aileron and elevator are operated by pushrods and bellcranks
• This area gets very crowded
• Ensuring adequate clearance and free movement can be a challenge
Rudder Controls

- Rudder is operated via cables running to a bellcrank/pushrod assembly in the tailcone
Rudder Bellcrank Mod

- Bellcrank pivot is an AN4 bolt riding in a brass bushing
- The bushing can rotate in the aluminum bellcrank causing the hole to enlarge
- Check for wear by having a helper move the rudder while observing the bellcrank
- If the bellcrank rolls fore and aft the pivot is worn
Rudder Bellcrank Mod (cont’d)

• Reference Lancair Service Bulletin L2K-RUDDER-BRACKET-UPGRADE.pdf

• Brass bushing should be a press fit in the bellcrank
Hydraulic System

- Pump may be located behind the baggage bulkhead or behind the seat back
- No functional difference, but significantly effects CG!
Gear Relay Options

- Bosch – small, low current draw, failure prone
- Automotive style – heavier, proven track record
- Gabriel Industries solid state – announced 5/2016
Prepurchase Inspection

• Don’t assume the builder knew what he was doing; have an expert inspect the plane
• Even if the plane was built professionally subsequent modifications may not have been documented (or wise)
• Be suspicious of large time gaps in the maintenance logs
• Verify that the weight & balance is accurate
• Gather as much history on the airplane as possible
Service Bulletins & Known Issues

- Continental Starter Adapter
- Motor Mount
- Nose Strut
- Brakes
- Gear Overcenter Links
- Rudder bellcrank
- Automotive Spark Plug Terminals
Starter Adapter Slipping
Continental Starter Adapter

- Spring wound around gear shaft tightens when starter motor turns
- If spring slips rapid wear occurs
- Undersize springs are available if the shaft is worn
Motor Mount & Nose Strut Issues

• Esco nose struts shimmy damping needs to be tested regularly
• Nose wheel shimmy can lead to motor mount failure
• Conversely, severe shock loads can crack the mount allowing nose wheel shimmy
  – Shimmy can break the travel stops leading to strut deflation and reduced prop clearance
• Excellent article on ESCO Strut Servicing: http://www.lancairowners.com/esco-strut-servicing/
Old-Style Motor Mount

Failed Here

No Gussets
New-Style Motor Mount

Additional Gussets
Can Also Occur on the Legacy FG!

- Second owner experienced minor shimmy on landing, severe shimmy during taxi
Updated Motor Mount

• Motor mounts delivered after 2004 should have the additional gussets
• New motor mounts may be purchased through Lancair or Snowline
• Lancair will provide the gussets free of charge
  – You are responsible for getting the welding done
  – Requires a hold harmless agreement with Lancair
Nose Strut Options

• Two types – Esco and WMI
• Esco struts are no longer available
  – Overhaul kits and instructions can be purchased from Lancair
  – Requires signing a hold harmless agreement
• New WMI struts are available for purchase from Lancair
Gascolator Drain

- When built per the manual, the gascolator drain is not accessible with the cowling installed.
Gascolator Drain (cont’d)

- Construction debris can persist for hundreds of hours
- Fuel sources may not be completely clean
- Don’t accept an inaccessible gascolator drain!
• Build manual recommends Nylaflow tubing with Tygon protective sleeve
• Nylaflow is fragile, kinks easily and has poor heat resistance
• Use real brake lines!
Automotive Spark Plugs

• Lightspeed ignition uses Denso X27GPR-U
• Equivalent NGK plugs p/n DPR9Z (4830) readily available at motorcycle shops
• NGKs don’t come with terminal nuts
• Aluminum terminal nuts wear out from vibration
  – Reuse is problematic
• NGK Spark Plug Terminal Nut p/n 1454-48
Lancair Service Bulletins

- **033-0004 LEGACY FG (8/10/2007)**
  Supplement – Legacy Fixed Gear

- **SB058**
  Lancair Legacy wheel well clearance

- **SB060**
  Lancair Legacy inner gear door reinforcement

- **SB067 LANCAIR 320, 360, IV/IV-P**
  Legacy nose gear strut clamp

- **033-0005 RUDDER PEDALS (9/18/2007)**
  Supplement – Legacy Rudder Pedals

- **SB059**
  Lancair Legacy rudder trim tab (kits 104-138)

- **SB064**
  Lancair Legacy fuel selector valve

- **SB074-0111 IV/IV-P/PROPJET**
  Legacy Landing Gear Overcenter Link
Overcenter Link Service Bulletin

- Cracks found in actuator attach tabs
- Until compliance, inspect before every flight
- Send overcenter links back to Lancair for upgrade
- Updated actuator end caps use spherical bearing for more freedom of movement
Rudder Trim Tab

- SB059-0801: hinge should be attached to trim tab skin with six rivets, not four
- Actuator arm secured to hinge with squeeze rivets and can loosen up over time
- If necessary drill out pop rivets and secure actuator arm with #6 screws and nuts
Engine Service Bulletins

Continental Motors provides a free searchable index by engine model number.
• Your engine doesn’t care whether it’s installed in an experimental or certified plane!
Legacy Canopy Safety

• An open canopy in flight leads to severe pitch instability
  – Less than 50% of known incidents have ended with a successful landing
• Strict adherence to checklists plus a warning system are strongly recommended
• Valin Thorn has studied this issue extensively and written an excellent paper:
  http://www.lancaiowners.com/legacycanopy/
Questions or Comments?

Thanks for watching!

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