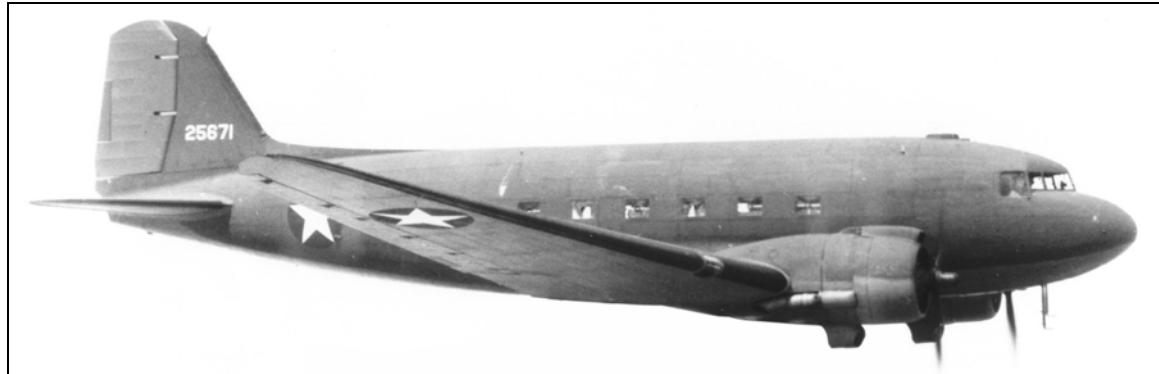


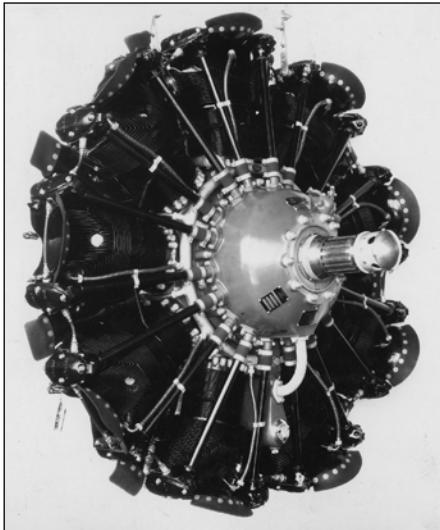
## Crew Chief Notes for N136PB / NC18121 / EAL 341

Version 6b – 16 Jan 02

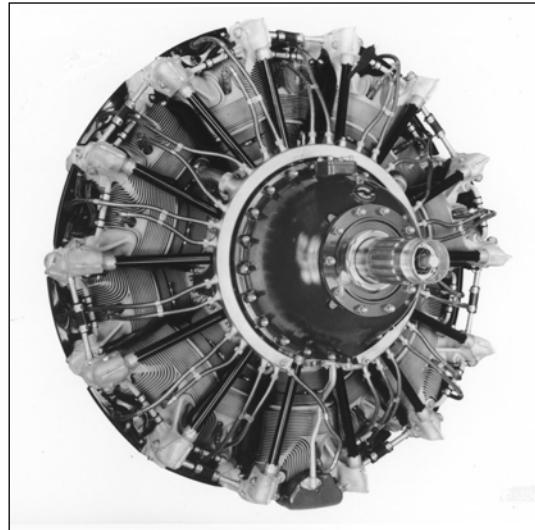
By "Buzz"



**C-47**



**Wright R-1820**



**Pratt & Whitney R-1830**

I wrote these bits 'o knowledge so the next guy doesn't have to re-invent the wheel. Does the arrangement seem odd? It's in Air Transport Association (ATA) chapters, one for each system, like the big iron at work. It's for my convenience so I miss fewer things. There is a pattern to it.

### Airplane History, abbreviated version:

This DC-3 was delivered In Oct '37 to Eastern Air Lines. Eddie Rickenbacker signed for the delivery at Santa Monica. She's serial number 1997, not many flying DC-3's are older than her. Most of them are the C-47 type, which is not a civilian DC-3. Yes, there is a difference.

Let's see, delivered to EAL as NC18121, their tail number was #341. She was pressed into service as a C-49 military serial number 42-56630, given back to EAL as the Air Corps got enough C-53's. Eastern kept it's DC-3's until 1953. Eastern Airlines used Wright engines, same size engine, but only 9 cylinders (and sparkplugs) to pay for.

Sold to Trans Texas Airways in '53 and converted to a DC-3A, Pratt and Whitney engines were installed and some systems were converted to late model C-47 stuff. She still had the same tail number N18121. A whole lot of parts have "TTA" stamped on them. On the hydraulic levers area, there is a cryptic

"TTA 19" stamped on the bulkhead. Bought by PBA in '74 and re-registered N136PB. In '86 she had surpassed the North Central DC-3 (87,000 hrs). I read that she was nosed over in a ground accident in '86. Bob has a footlocker of PBA records. PBA was absorbed by Eastern Express, and retired in '88.

She and N130PB were preserved by some Continental guys who appreciate history. N130PB was rebuilt into a mid 50's Continental DC-3 and lives in Houston. She's good looking.

In May '93 Neil and Bob bought her, we woke her up and ferried her out here. Since then we've done a heavy airframe overhaul, including SB262, wing attach angle rework. Wings were re-attached in May '98, engines woke up in Nov '98.

When we ferried her out here in May '93 she had 91,400 hours on the airframe, more than any other airplane. Now there are a handful of 747's that have exceeded her, but somehow it's not the same. I hear that some UPS DC-8's are past the 90,000 hour mark too.

### **Chapter 06: Dimensions and Area**

Wingspan of 95 feet, 65 feet long, tail is 23 feet high when level, 17 feet high at the cockpit in tail down attitude. Main gear is about 20 feet across the wheels. Props are 11 1/2 feet across. There is 5 inches clearance at the prop tips to the fuselage. She's a "lightweight" DC-3, 26,200 lbs. OK, so these are rough numbers Bob, if it really matters to get it in the hanger, I'll bring a tape measure.

### **Chapter 07: Tow and Taxi**

1. She tows from the tailwheel, make sure the towbar you use will clear the tail feathers. If it's too short the front of the tug scrapes off the fabric at the elevator trailing edge.
2. It can be pulled from the main gear if you're stuck in mud or snow, make sure the gear pins are in. The North Central book shows a tow bridle of 1 1/8th inch rope. It'll break before the gear is damaged.
3. For pulling the airplane loose from a ditch, chain the gear links aft to the big horseshoe. That way the gear won't fold. I guess it doesn't overstress the downlock pin fitting at the forward spar.
4. Don't push her hard from the tailwheel, but you can pull all you want.
5. Taxiing a DC-3 is like sailing a boat – it takes skill. There's no direct connection between the rudder pedals and tailwheel. You need two engines to "blow" her in the desired direction. The rudder and brakes can also "suggest" where the airplane should go. It's nothing like taxiing a modern airplane.

### **Chapter 09: Lifting and Shoring**

1. We jack from the wing jack pads. North Central has a procedure of using a pair of 10 ton bottle jacks under the strut to change a tire. Seems pretty wobbly to me, I wouldn't do it unless in a hanger (level floor, no wind).
2. The wings have screw in tie downs to sling them, 4 point attachment.
3. When I jack her up to change a tire, I chain both sides of the struts so the strut doesn't extend all the way. It saves some jacking. And wrap the chain around both sides of the axle, so it won't twist. There's about 1500 psi in those struts.
4. The tail jack pad fits into a slot in an aluminum block about 4 feet aft of the tailwheel. I made a steel "T" to keep the jack from damaging the aluminum block.
5. There's a tie down ring in the wings that pulls out for ground tie downs. It's about 10 feet from the tip.
6. When we weighted her in March '00, she was a svelte 17,750 lbs. That was about 8,000 lbs on the main tires and 1500 lbs on the tailwheel. Bob calculated the C.G. at 13% MAC. Limits are 11% forward, to 27% aft. Since then we've added ballast aft, 600 lbs or so. So the CG should be about 22%.

### **Chapter 12: Checks and Servicing**

1. I don't know how Neil and Bob will do this one, she could qualify for progressive inspections, avoiding the need for an IA signoff. But an IA has to be in charge per FAR 43. We'll probably do annual inspections in Part 91.
2. We use the North Central Maintenance Manuals, Air Force C-47 manuals, and there's a book of service bulletins that's 5 years old.
3. Wish we had a wire map for the airplane, it's unique, probably standard Trans Texas Air. It resembles the North Central Manual's type D ships.

## **Chapter 20: Airframe General**

1. This airplane started off as an early model DC-3 with Wright 1820 engines (G202's). In '53 she was converted to a late model DC-3A with Pratt and Whitney engines and late model systems.
2. There are many things in the Air Force C-47 manuals that apply, and many that don't. This is NOT a C-47 and doesn't have some things they did.
3. Like wise there are a lot of service bulletins and AD notes, read carefully to decide what applies and what doesn't. Somewhere, Bill has a list of ADs and service bulletins that apply and how we have taken care of them.
4. The empty basic airplane weighs about 18,000 lbs.
5. Our cockpit overhead panels are unique, definitely NOT C-47.
6. There are 2 data plates, one in the cockpit by the hydraulic tank that Trans Texas put in. A different one is aft of the RH aft baggage door, labeled "McDonnell Douglas DC-3" This DC-3 wasn't built by McDonnell, the fighter guys in St. Louis!

## **Chapter 21: Air conditioning and Heating**

1. Janitrol heater has been removed. Bob doesn't like the idea of a fire breathing dragon inside the cabin. Big aircoop still in place.
2. No exhaust muff heaters either. Wear a sweatshirt.
3. Nose aircoop is wired closed, the open-close knob was in the way of the copilot's knee. So we removed it. Maybe later we'll install it.
4. There are a few distribution ducts under the floor, forward of the wing.
5. Radio rack has a cooling fan, and venturi scoop. I think the fan was for the eyeball outlets. I removed the fan and taped the wire, it's hot with the battery on.
6. You can open the cockpit windows in flight, or remove the overhead hatch \*before\* flight. The Salair pilots say little wind blows in and it was nice to watch the stars at night in the summer.
7. The ducts along the floor at the side wall are connected to venturis on the lower aft fuselage. I guess air flows out of them.
8. There are ceiling vents, they don't leak in heavy rain.
9. There's a "blanket" in the nose, snapped in place forward of the instrument panel. I guess it keeps some wind out.

## **Chapter 22: Autopilot**

1. Air breathing, organic, activated by coffee or a swift jab in the ribs. There are brackets under the floorboards for actuators. The equipment's long gone.
2. Where the autopilot panel used to be, now it's engine gauges. Ours isn't like the RCAF manual. Their CC-129 had engine gauges on half the copilot's panel.

## **Chapter 23: Comm**

1. Lots of tube radio gear in the radio rack aft of the cockpit Trans Texas installed it in '53.
2. Two Comm radios, two navs. Bob plans to have the radios re-done at a shop.
3. Flight Interphone is pretty weak. Either that or it's noisy in the cockpit.
4. Two transponders were installed, one under the beak, one behind the Captain's seat. There's a main-standby switch in front of the Captain. Both are missing, maybe one is in the Ercoupe. The altitude encoder is on the radio rack and has a static port connection. I don't know how you'd dial in a transponder code. See 23.4a below.
  - 4a. The transponder is a King KXP 576, a unique double transponder (main-stby) with a control head on the copilot's panel. You set the squawk there. The box is on the radio rack, the head is under the beak. We took out the "spare" transponder behind the captain's seat.
  5. The radio rack arrangement resembles type D ship in the North Central manuals.
  6. The ADF is in front of the Captain's knees, the box is in the radio rack (and is missing). It's an old King 120 in the cockpit. I wonder if it needs whatever ADF box is missing on the radio rack? And the antenna is a long wire (12 feet long) on the belly.
  7. There's a couple inverters that turn DC into AC, don't know what they power.
  8. There's a bunch of terminal strips on the forward side of the radio rack, I think they do radio gear. There are more terminal strips buried deep in the lower half of the radio rack.

9. The big lower curved antenna is for Comm 1. The upper whip antenna is for Comm 2. Just the opposite of the modern airliners. The big antenna forward is for the VOR. There are a few DME / Transponder antennas on the lower nose.

### **Chapter 24: Electrical**

1. Two big 12-volt batteries drop down on trays below the nose. They're wired to make a 24 volt airplane. The trays are spring loaded up to help you stow the batteries. \*Make sure the fore-and-aft pins are really in the holes when you latch the battery trays up\*Oh yes, you –can– install both batteries backwards and get no battery power, relay doesn't sense right.

2. The master switch is labeled "Batt Cart /Off/ Ships Battery", 3 position switch. You select the position. In the Battery Cart position, the Ship's batteries do not charge.

3. It's a DC airplane with no AC power to run the airframe stuff (fuel gauges, position transmitters). I think there's an inverter for the radio gear, but it doesn't power the Nav/ Comms. Wonder what it was for?

4. There is a 200 amp generator on each engine.

5. Generator relay closes about 1300 RPM.

6. The batteries were new in '93 but were neglected once we got home. I've been charging them, but the amps don't taper off. I don't know how strong they are.

7. The "Battery Cart"/ External Power plugs in under the nose section, aft of the battery wells, almost as far back as the wing leading edge. The door has a micarta block on the inside to hook on the power plug so gravity doesn't back it out.

8. Electrical gauges: There are two ammeters above the copilot, no voltmeters in cockpit. If you really want a voltmeter, look under the radio rack. Open up the door that covers the circuit breakers and you'll see one.

9. Circuit breakers are below the Radio Rack, at floor level. Swing up the door and you'll see them. A light comes on when the door is opened.

10: How do you charge the batteries? Open up the hatches, slide the batteries down. Hook up the battery charger to one battery and connect jumper cables to both batteries so they both get charged. REMEMBER to charge it at 12 volts this way, not 24.

### **Chapter 25: Cabin**

1. No toilet installed. Hope you can last 4 or 5 hours.

2. When we picked her up she had seats for 30. Bob likes the idea of a row of single seats down each side. No telling what we'll have to fly to Oshkosh with.

3. Baggage: There is no under-floor storage. All the baggage goes in the aft compartment, or forward baggage bay across from the radio rack.

4. The aft baggage compartment is accessible in flight. There's a light over the aft baggage door, if the power's on it makes closing the door from the inside (for engine runs) not-so-dark.

5. The farther aft you go, the quieter the cabin is.

6. All the wires and one static pressure line go through the overhead, along the spine of the aircraft, where the overhead speakers are.

### **Chapter 26: Fire detection/Protection**

1. The firewalls have thermocouples for the accessory section. The relay (Edison) box is under the Beak way up in the nose. There are two thermocouples in the top of the wheel wells, the rest are in the accessory section. Fifteen total.

2. There is a CO2 bottle for engine fires. The spray tubes go down the carb, and ring around the accessory section.

3. There is a light, and bell on the Captain's panel for fire. The bell didn't work in Louisiana. I don't know if the bell is audible, according to Nancy's story about an engine fire, "Can you hear it at takeoff power?" Nancy couldn't. The red lights got her attention.

4. The thermocouples are wired in series, if one goes bad it takes down that whole side. There's a junction box / terminal strip above the boost pump to ring it out. Each Thermocouple should only have half an ohm of resistance.

5. The engine fire bottle is installed in the copilot's corner of the cockpit. It's a large CO2 bottle, hydro tested in Sept. '99 and recharged at Huser in downtown Portland.

6. The fire bottle is discharged by pulling a cable on the floor between the pilot's seats. Better select which engine you want it to go to first. There's a T-handle on top the bottle too, but that doesn't select the engine. I've wrapped copper safety wire (break-away wire) to show if the handle has been twisted, and the bottle's been shot.

7. Under the copilot's window there's a red thermal blowout disk.

### **Chapter 27: Flight Controls**

1. All surfaces are fabric covered. We stripped off the old fabric from the elevators and rudder, epoxy primed the structure, covered with Stitts fabric. It should be good for a few years. We used aluminum dope, then poly paint (aluminum color) was sprayed on it. Fabric was finished in Sept 98. Ailerons were cleaned, scuffed, silver painted.

2. Flaps are metal, one hydraulic actuator and pushrods drive the whole affair.

3. The ailerons are SUPPOSED to droop 7/8th of an inch below the upper surface of the wing. It's a rigging thing.

4. Trim tabs are rigged by finding the tiny cable under the floorboards, finding the little "mushrooms" soldered to the cables and turning the crank so the mushrooms are side by side. That sets the cables / mechanism to neutral. Next you adjust the tab, screwing the pushrod in or out to fair the surface and tab (get them in line with each other). Last, you tweak the needle on the pedestal. I rigged the trim tabs in the Spring of '99 after ailerons, elevator ,and rudder were hung. We'll see how straight she flies.

5. Small holes are cut in the fabric to slide trim tab attach bolts through. Then you glue a patch over the hole you cut in the fabric.

6. The control wheel (yoke) will rotate 180 degrees (roll all the way over) for maximum aileron deflection. Modern airplanes only go 90 degrees.

7. Gust locks: Five are installed outside, and a bungee between the yokes. I've got a blue plastic milk crate to set them in for flight, in the aft baggage bay. Bob says the rudder hinges are delicate, leave the rudder gust lock on until the very end.

8. Ailerons are really long! She's a little heavy in roll (I had a couple hours of stick time ferrying her out).

9. For ground run ups, remove the elevator gust locks so you don't lift the tail. Pull the yoke back to your lap when you're above idle.

10. I applied Dinol to all the flight control attach hardware so it won't rust. It's a brown liquid.

11. Next time I hear about the wing attach angle job, get the aileron cables pulled out enough to connect them BEFORE the wings bolt on. I had to fish them out with a long bent welding rod. And it took a dozen hook up tries to get the twists out of the aileron trim cables.

12. The ailerons have two bellcranks and two pushrods each, one inboard (by the trim tab) and one outboard.

13. North Central has a rigging procedure to correct one wing heavy – they'd dope a foot long length of string and fabric tape to the aileron.

14. I bungee a pole with a plastic owl on the rudder hinges, it keeps the birds from pooping down the rudder. Remove before taxi.

### **Chapter 28: Fuel**

1. There are 3 tanks: Left, Right, Left Aux. The tanks are welded metal boxes, not bladders, not integral. Each tank is about 200 gallons. At 85 gallons per hour that's 2 1/2 hours of flying per tank.

2. There is an engine driven fuel pump on each engine, and a DC boost pump for Left, and Right. An overboard drain drains shaft seal leakage from the boost pump.

3. The boost pumps are at the inboard, aft corners of the wheel well.

4. Fuel pressure is 14-16 psi. The carburetors are made to handle that low pressure for takeoff power. More pressure is NOT needed to make 1200 HP for takeoff. Fuel pressure gauge comes from the back of the carburetor, fuel pressure warning switch (light) lives in the wheel well.

5. You cannot shove fuel from one tank to another (no fuel transfer). But the engines can suck fuel from any tank (crossfeed).

6. There's a small hatch above each fuel tank quantity transmitter, makes getting to it nice.

7. The fuel quantity gauge does not have a selector knob like the RCAF manual shows All 3 gauges read all the time.
8. A fuel tank selector determines which tank will feed which engine.
9. The fuel caps tend to leak water into the tank in the rain. Sump them before an engine run. Aerodyne would wrap a tarp over the inboard end of the wing to cover the fuel fillers. And they would do a run up, enough thrust to lift the tailwheel off the ground, then shut down and sump again. They lost an airplane on takeoff due to excess water in the fuel. "No Cheap Kills."
10. There's a wheel well fuel strainer and sump, usually it sucks air in there, I don't get much fuel out. I think it depends how full the fuel tanks are, if the fuel strainer is higher than an empty tank, it gets air.
11. The engine fuel pumps are made to suck fuel around the boost pump if it's not switched on. At idle they only give 10-12 psi, at cruise power they have 14 psi.
12. There's a calibrated fuel dipstick in a holder near the hamburger door.

### **Chapter 29: Hydraulics**

1. The ship uses red, petroleum 5606 hydraulic juice. You fill it just aft of the cockpit. The tank drain is outside, panel just forward of the RH battery. It's about 6 gallons.
2. All the confusing parts of the hydraulic system are installed behind the copilot. The pressure regulator moans when you taxi.
3. The hydraulic pressure gauges are installed on the RH side wall of the cockpit, below the sliding window. There are two gauges; one shows gear down pressure (Landing gear actuator down) and one shows the pressure coming off the engine pumps going to the system in general.
4. It's a 600-800 psi system. At 1000 psi the system relief valve opens. Accumulator pre charge is 250 psi.
5. The hydraulic reservoir has a sight glass in the aisle. When the pressure is up, the fluid level is down. Make sure you're looking at the correct arrow for the correct level.
6. Cowl flaps are run by hydraulics. Controls are by the copilot's sliding window.
7. Neil has a 55 gallon drum of 5606 fluid.
8. Hydraulic things: Brakes, Landing Gear Retraction, Flaps, Cowl Flaps. Windshield wipers are hydraulic, we have no arms / blades for them. And so far we do not have the hydraulic gear retract bungees. Bob has plans....
9. "Split the Handles" of the landing gear, and flaps on the ground to prevent hydraulic pressure from getting excessive. If the handles were in neutral, the pressure is trapped
10. Flap selector valve handle center screw/bolt needs to be no more than finger tight (I safety wired ours) so the flaps won't bleed down in flight. It pulls the selector valve out a bit when it's too tight and the pressure bypasses the valve's guts. Flaps go to about 15 degrees even with the handle up, airspeed gets slow for no good reason. You can see if the flaps are down – even just a little – from the last couple cabin windows.
11. The yellow "star" valve is supposed to be safety wired closed. It locks the accumulator out of the hand pump / users circuit.
12. The hydraulic panel moans when you're doing ground runs, pressure regulator is in there.
13. You can set the brakes with the gear up, bad news when you land.

### **Chapter 30: Ice and Rain**

1. Windshield wipers: the hydraulic motors are installed, arms and blades didn't come out with us.
2. The Pitot / Static tubes are heated, but the wires aren't hooked up yet. Now they are warm and working.
3. There are no wing / tail deice boots installed.
4. The Alcohol tank is not installed yet. It's supposed to feed the windshield, props, and carb anti-ice.
5. No windshield heat, as in defog / defrost. Remember, she came from Florida.
6. The rubber boots were removed long ago, holes plugged.
7. We have no Prop deice (alcohol) installed.

### **Chapter 31: Instruments**

1. There are two vacuum gauges. The left one is for the left engine's vacuum pump, the copilot's gauge comes from the RH engine. Watch the left Gyro horizon when you start the left engine, Right Gyro Horizon when you shut down the Right Engine. The vacuum gauges are on the lower outboard sides of the instrument panel, the photo doesn't show them. The vacuum systems are plumbed together, both pumps feed one system.

2. The Gyro Horizon is vacuum driven, each side has a vacuum gauge, low and outboard on the panels.

3. There are two separate pitot systems, one common static system. There are a pair of static ports in the aft fuselage, aft of the baggage compartment AND static ports on the pitot probes. The Pitot probes used to be installed on the Beak, we installed the original (mast) probes. We didn't remove the modified static system.

4. The altitude encoder is on the radio rack and has a static hose going to it. I had to isolate the static system selector to get her to test, might be sucking air through the encoder plumbing?

5. Pitot static test done summer '99.

6. Most of the engine gauges are self powered: Thermocouples for CHT, Carb air temp. Oil and fuel gauges have restrictor tee fittings. Make sure the restriction is going to the cockpit – it's a .050 inch hole. Oil and Fuel Low Pressure Lights come from pressure switches in the wheel well.

7. She's got a Stormscope. It worked on the way out here. Remember, she came from Florida.

### **Chapter 32: Landing Gear**

1. Tire pressure is 50 mains, 35 tail. Struts are about 4 inches each.

2. Tire change? Chain the struts before jacking so you don't have to lift as far. But don't block the lower axle clamp.

3. The maintenance manual has you retract the gear a few inches to get the axle loose from the clamp. You can keep jacking if you want. I'm gun shy about moving the landing gear handle on the ground.

4. Landing gear horn: if the handle isn't pressing the switch in (handle down) and the battery is on it will make noise. Is it the RH horn?

5. Brakes are Goodrich Expander tube style. New hydraulic bladders are about 800-1000 bucks each. There are rebuild instructions in the North Central manual.

6. RH main tire changed in July '99 due to hydraulic fluid leak (for about 10 years) from #3 brake. Installed a new brake bladder on #3 brake. Checked all the brake wear. Numbers 1 and 2 brakes were rusted on the axle, had to torque them off with a long cheater pipe. If you grease the axle / brake sleeve it won't rust together.

7. The rims were painted inside by some thoughtful guy years ago.

8. We have teeny jack pads bolted on, the jack rests on the two aft pad bolts as much as the cone of the jack pads.

9. Bungee gear: There is a multiple strand bungee in the upper aft wheel well, upper engine nacelle fairing. It pulls up on the landing gear. The Air Force manual says to use a 4000 lb hydraulic jack to remove the spreader bar when changing bungees. That's a lot of pull.

10. When doing engine runs or towing, pump up hydraulics to 500 psi for safety, star valve open?

11. Brake pressure for Goodrich Expander brakes is only 160-180 psi max. When they are released gravity gives 6-8 psi. Good News! The brake hoses have self-sealing quick disconnect couplings. You don't have to cap-plug the brake hoses when you remove a wheel.

12. The small knurled knob on the brake bleed fitting is for brake adjusting.

13. The tailwheel is for pulling, not pushing. Bob says it's hard on the tailwheel oleo. Wonder what happens if you spin the tailwheel 180 degrees and then re-hook up the towbar and push? The tail sits about a foot higher with the tailwheel 180 degrees forward.

14. There are no centering cams in the tailwheel, that's what the tailwheel lock is for. But gravity tends to pull it in the right direction for flight.

15. Tailwheel lock is a drop down peg that fits in a notch of a collar. Pull the cable to release (back in the tailcone compartment) Remember "forward for flight" locks it on the cockpit handle There's a shear pin inside the tailwheel strut tube on C-47's.

### **Chapter 33: Lights**

1. Landing lights are relamped through a small panel aft of the lens. Don't remove the big glass Leading Edge lens if you can help it, it's hard to get everything back together. I don't know if it has a time limit for ground ops, they're 600 watts.

2. Nav lights have a flasher position, they blink. There's an upper and lower fuselage white blinker. There's a large cylinder with a cannon plug on the forward lower radio rack. Thump it if the flasher doesn't work, sort of like DC-8 rotating beacons.

3. Two lights in the tailcone, I think the upper one was red.

4. There's no wire map in the North Central books for the Anti Collision Rotating Beacon. The Air force book has a basic schematic.

5. Aft baggage bay has a light that works whenever power is on.

6. Radio rack circuit breaker panel (under the door) has a light that comes on as the door is opened.

7. Wheel well lights have a switch in the cockpit.

8. We don't have leading edge ice lights, maybe that's what the Aldis lamp was for?

9. The tail's red rotating beacon "Anti Collision" light has a switch on the side of a junction box, up in the ceiling, by the radio rack I don't know why it shuts off the beacon. Make sure it's 'on'.

### **Chapter 35: Oxygen**

1. Bring your own bottle, none installed.

### **Chapter 38 Toilet and Water**

1. No toilet, hope you can hold out for 4 or 5 hours.

2. Bob has a sink assembly on the rack of spare parts, maybe someday.

3. One idea is to put a porta-potty in the aft baggage bay. First guy to use it cleans it out.

### **Chapter 51: Structure in General**

1. The DC-3 and C-47 are similar. But it seems that a lot of skin sheets on a C-47 are one gauge thicker. Sometimes rivets are one size thicker (Compare the DC-3 vs the C-47 structural repair manual). And this passenger ship does NOT have a reinforced floor.

2. The aft cabin bulkhead is probably a couple feet farther forward than what Eastern had. There used to be a hanging closet across from the door when we ferried her out here.

3. When we did SB 262 (wing attach angle AD note) we used zinc chromate primer in the wing. Gray epoxy primer was used in the fuselage.

4. The cabin floorboards down the aisle are plywood, the rest are corrugated aluminum.

5. The fuel tank area was zinc chromated as was the wing attach angle area. The fuel tank stress plates were epoxy primed, then aluminum, painted.

### **Chapter 52: Doors and Windows**

1. The "hamburger door" aft of the cockpit clears the prop tips bay two inches. It's forward of the prop, so if you use it with the left engine turning you'll be hamburger. Being a crew chief and hearing "hamburger door" the first time, I wondered why somebody would pass the lunch up to the cockpit that way.

2. The cabin door was modified, airstair door installed by Trans-Texas in '53. The chain hook is required by AD note so the door can't flop open in flight. Maybe Eastern installed it according to Chuck H.

3. The nose has a large hatch, whole top of the Beak opens up like a car's hood. It's handy for doing instrument panel work. I broke one of the four screws that secure it, made a replacement at work. That's why there's a 12 point bolt up there.

4. The cabin window exits are hard to re-install. And you have no wing to step out on to, just drop to the ground, not the wing walk.

5. The new cabin door latch works just fine, it locks the handle.

### **Chapter 53: Fuselage**

1. She was nosed over in the mid 80's, the replacement lower nose had "305" in the paint under the "36" that PBA wore. So it wasn't from another PBA ship. There's a magazine clipping about it somewhere in Bob's collection, and in the records

2. The fuselage had 3 lavatory drain hatches. In '95-'96 Bob and I replaced a couple sheets of skin to solve the problem of too many ugly panels.

3. We stripped the cabin and did a bunch of corrosion repair. About 3% of the fuselage rivets had popped heads (corrosion, paint stripper) and were replaced. We replaced several areas of corroded stringer, and window frame corners. After that was done Mark epoxy primed the interior before the sound insulation went in.

4. Aluminum and foam sound insulation was stuck down, foam on top of that.

### **Chapter 54: Cowlings and Nacelles**

1. Cowl flaps are hydraulic powered. The cowl flap selector is on the copilot's side wall. In the "trail" position the fluid is shut off and the air load determines how far open they should be. Nancy says the ship has a vibration when they're open in cruise. So bring them to trail.

2. Open the cowl flaps before trying to remove the cowling. Smart crew chiefs will have a couple of 9/16 hex (1/4 i.d.) caps and plugs to cap off the hydraulic line.

3. To remove cowling:

- a) First have the cowl flaps open so you can reach in, take off the hoses and cap the ends.
- b) Next remove six safety pins: three on the cowl flap rods and three on the nose latch hooks. Disconnect the nose latch hooks (inside the nose of the cowl) and cowl operating rods under the cowl flaps.
- c) Unbolt the safety bolts through the two bottom latches, swing them open.
- d) Get a work stand and a Dzus screwdriver and gloves. Unhook the Dzus fasteners and pick up the lower cowl section, walk away with it. (wear gloves).
- e) Un-Dzus the other side, walk away with it.
- f) To remove the top, get a ladder on each side. Push both sides straight up a foot to clear the aircoop, rotate it toward the work stand, walk away with it.
- g) DON'T lay the cowling shiny-side down, it gets scratched. I'll crunch you!

4. The cowling rests on stubs bolted to the cylinders. The stubs have rubber hose slid over them so it doesn't chafe badly. Make sure all the hose bits are still there when you install cowling.

### **Chapter 55: Stabilizers**

1. The horizontal stabilizer fairings were corroded, new ones are installed.

2. Bob had another set of Horizontal Stabilizer tips installed, the original ones had been over-buffed by a polisher.

3. John Lane's shop made a new upper dorsal fin. The old one was corroded.

4. Elevator and rudder hinge arms have been removed for our convenience in the hanger (easier walking around), cleaned and primed before installation.

5. Horizontal Stabilizer leading edge was removed for access, drain holes made, and primer was sprayed inside. The bottom of the stabilizer was painted silver.

### **Chapter 57: Wings**

1. Bob says one wing is off a C-47. I'd guess it's the Left wing, rivets are bigger diameter there. The right wing has a metal tag with "EAL 332" stamped on it, near the inboard end of the aileron.

2. All the fuel tank stress plate bolts are new along with wing attach angle hardware. That's 642 bolts, 140 inch pounds of torque.

3. Center wing stress plates are painted silver. Bob thinks the whole belly should be silver.

### **Chapter 60: Propellers**

1. The Hamilton Standard props are subject to the 18 month / 5 year AD note. They're looking for hub corrosion. It's AD 81-13-06.

2. Props were rebuilt, stored on a stand in the hanger. In '98 we hung them.

3. The original blades we flew out with were too corroded to save, Neil got some new-old blades still packed in Cosmoline.

4. Feather pump is in each wheel well, sucks oil off the bottom of the tank. When you unfeather the prop, it dumps oil into the nose case of the engine. We almost hydraulic'd an R-2800 that way once. The oil drained through the rings, into a lower jug.

5. The props are Hamilton Standard Hydromatic props (not the Curtis Electric) The prop governor sits on top the nose case, out in the breeze.

6. Inspect the prop governor cable by holding a rag on that last pulley at the forward side of the cowl. Have somebody in the cockpit run the prop knob back and forth. Broken strands in the cable will snag the rag.

7. There's a service bulletin to cycle the Feather pump on the ground with engines off every 30 days. Somebody had a feather solenoid stick and the prop kept cycling in and out of feather. They had too much drag to stay airborne. After you feather-unfeather the prop, pull the plug on the crankcase and drain out the oil. When you un-feather a prop, the oil dumps into the nose case of the engine. So you need to pull a drain plug between the banks of jugs to let the oil out so you don't hydraulic a jug.

8. The props feather, and keep a constant speed, but they don't reverse.

### **Chapter 71: Engine General**

1. Firewall forward fuel, oil, hydraulic hoses replaced Sept / October '99

2. One engine has about 1100 hours, the other has about 250 hours.

3. These are R-1830 dash 92 engines.

4. Don't work the engines hard until you have 40 degrees Celsius on the oil temperature and 125 on the CHT. Normal CHT is 180 or so.

5. The Pratt and Whitney Twin Wasp R-1830 engines are 14 cylinder engines (not 18 jugs like R-2800's). The Wright Cyclone R-1820 engines have 9 jugs and fewer parts to buy. They must be cheaper, lots of people had them. The North Central manual calls them G202 engines. Wright engines turn slower at takeoff power (2500 versus 2700 rpm). Don't confuse the two engines when you go trolling through the manuals.

6. Number 1 jug is the top rear, straight up.

7. If you walk around the airplane, get in the habit of walking outboard of the landing lights. It'll keep you from getting bit by the prop during engine runs.

8. Ground check, high power run: at field barometric pressure (about 30 inches manifold pressure) you should get 2350 RPM (plus or minus 50) since we've got the narrow prop blades. Paddle blade props have a different number.

### **Chapter 73: Fuel Control**

1. Carbs: RH carb replaced with a Salair rebuilt spare. LH carb rebuilt Aug '99 by Wesco in Arlington Wa.

2. These carbs have an angled base where it bolts up to the engine. The Wright engine carbs are the same basic number, with a flat base.

3. Carb air temp is measured in the adapter between the air scoop and top of carb.

4. The primer sprays fuel into the blower throat. No "spider" on the upper jugs like the old R-2800's.

5. Nancy's Technique on engine prime: Auto rich for a few seconds before crank. Crank with mixture in Idle-Cutoff.

6. These Pressure Carbs cannot be field overhauled, must go to a shop, it's in the FARs. But you can adjust speed and idle mixture. You watch the RPM rise a little as the engine shuts down.

### **Chapter 74: Ignition**

1. Spark plugs: Champion RHB32E's are the proper plugs for an 1830 engine. The spark plugs screw into a bronze bushing (left hand threaded into the head). Some have helicoils. DO NOT run a spark plug tap to clean up a helicoil.

2. There is a big canon plug at firewall, removing that makes the magnetos hot.

3. RH magneto fires the front sparkplugs, LH fires the rear. Memory hook: Number 1 cylinder is the top rear, and you usually think of the Left side first.

4. Do a mag check in Auto-Rich, not Auto-Lean. You're pulling some power.

5. The mags are mounted on the back of the Accessory case, not the nose case like R-2800s. If you see a DC-3 with Pratt engines and nose case mounted mags, she's got 1830-75 engines.

6. Magnetos are Bendix-Scintilla, not Bosch.

7. The Ignition Vibrator (called "booster" in the cockpit) fires up a shower-of-sparks for the RH mag, front plugs.

### **Chapter 77: Engine Indicating**

1. Most of the gauges are self powered, they have the green-yellow-red paint marks on them. They are either direct reading (pressure) through a restrictor tee in the wheel well, or a thermocouple type of temp gauge.
2. The Cylinder head temp comes from #13 spark aft spark plug (LH engine) or #3 aft (RH engine), gasket type thermocouple. The RH engine's helicoil for that plug is jammed, hard to turn that plug. I spray painted a yellow spot on the baffles to remind us.

### **Chapter 79: Oil**

1. We use 50 weight straight un compounded (not ashless dispersant) oil.
2. The oil tank is placarded for 20 gallons. If you fill it brim full, the last few gallons blow overboard and down the wing walk. Bob says keep it less than 23 gallons. It's a 29 gallon tank.
3. There's a dipstick for each tank, the top of the dipstick says 29 gallons.
4. The oil cap is.... Weird. You push it in the middle to unlock it and you lift it off. Then you flex the top out to clip it on the mouth of the oil filler. I don't know why it's that way. Wonder if we'll change oil tanks to get a "normal" oil cap? Or to clean all the sludge off the bottom?
5. The engine oil screen has a generous size spring to fight when you put the cover back on.
6. Oil burn was 4 quarts per hour on the left engine, 5 quarts per hour on the right engine. The left had a leaky prop seal, the nose cowl would get splattered as we flew. The right engine stayed clean. Still, plan on a gallon per hour of oil burn, 85 gallons per hour of fuel burn.
7. There is a procedure to "boil out" a dirty oil tank: Drain oil, pour in a few gallons of Varsol solvent, insert an air hose, low pressure air. The vapors will de-sludge the tank. Flammable Vapors!
8. The prop feather pump sucks oil from the bottom of the tank .
9. A plastic cafeteria tray is pretty handy for collecting drips when you remove the oil screen.
10. Most DC-3's have a Hopper in the oil tank for faster warm up: the hot oil from the engine flows through the hopper and warms up / draws in cold oil. North Central removed theirs, it's located above the oil out hose in the oil tank.

### **Chapter 80: Engine Start**

1. It's a direct crank starter, not the inertia (accelerate -mesh) variety.
2. Mag switch has the big pushbutton On-Off switch, and a switch for each engine - mag.
3. There is a Left-Right engine selector gang bar on the Copilot's overhead. It's unique, not like other DC-3's. Must be standard Trans Texas Air. Delta's Ship 41 has the same arrangement. Whatever you want (Primer, Starter, Ignition Booster) you have to direct to the Left, or Right engine with the Gang Bar / Palm switch.
4. Mags have a "Shower of Sparks" vibrator in a can near the RH mag. It feeds the RH mag - front sparkplugs. It's labeled "Ignition Booster".
5. We walk props through before start (gently!) to detect hydraulic lock, even with the direct crank starter. Why gentle? Because you have 6 feet of leverage, and can muscle your way through a hydraulic lock. Read Pratt & Whitney Engine Operation Information Letter #24 to broaden your knowledge.
6. I've made a Mechanic's Engine Run Checklist for us ground pounders. One copy is back by the hydraulic tank, on the shelf.
7. The prop turns about half an RPM when cranking, as the jugs fire she speeds up. It doesn't need to wind up fast like a turbine engine.