



RV-3B N3NU
- HACK JOB -

HIGHLIGHTS

Begun09 September 2008

Airworthy04 December 2009

First flight11 December 2009

384 work days, 2,298 shop hours, and 12,837 net rivets

Air Venture 2010 Champion—Bronze Lindy



HACK JOB???

The common definition of a *hack job* relates to a task completed in the quickest possible time at the expense of quality or attention to detail. It took 15 months to complete N3NU; so, at least the quick part of the definition may apply. But, the rest of the definition, that relating to quality, certainly does not apply.

So, why name N3NU *HACK JOB*? The answer relates to the word *hacker*: one that modifies a perfectly good product to add some character, make it distinctive, and hopefully, make it better. I am an unapologetic hacker and thus the name, *HACK JOB*.

Descriptions of my hacks follow a page describing the systems in N3NU.

John Nystrom
July 2011

Systems



- Lycoming Y10-320 D1A 160 HP engine with MTV-11 propeller and two P-MAGs
- Vertical Power VP-X Pro electrical hub with separate 6-fuse buss
- Single PC 680 battery and 60-Amp Plane Power alternator
- GRT Avionics EIS 4000 Engine Information System (EIS)
- GRT Avionics Horizon HX Electronic Flight Information System (EFIS)
 - Inputs: Engine from EIS, electrical from VP-X, GPS, traffic, and XM weather
 - Outputs: Lateral (GPSS) and vertical (GPSV) steering to autopilot, air data to transponder, and VP-X
- MGL ASX-1 backup altimeter and airspeed indicator
- XCOM 760 VHF radio
- Garmin GNS 430W GPS/NAV/COM
- Garmin GTX 330 mode-S transponder (feeds traffic information to the EFIS)
- TruTrak Digiflight II VSGV autopilot (autonomous, EFIS, or GNS 430W driven)
- VX Aviation AMX-2A audio mixer for VHF, traffic, music, and EFIS warnings
- Automatic Packet Reporting System (APRS) for real-time position reporting
- Smoking Airplanes smoke system



Counter-balanced elevators (original design):

Stock RV-3 elevators are not counterbalanced. RV-4 elevators have a counter-balance tab extending to the leading edge of the horizontal stabilizer. RV7 elevators have tabs nested behind the HS leading edges. N3NU's tabs are similar to those of an RV-7.

In flight, the controls are well balanced with no adverse effects.

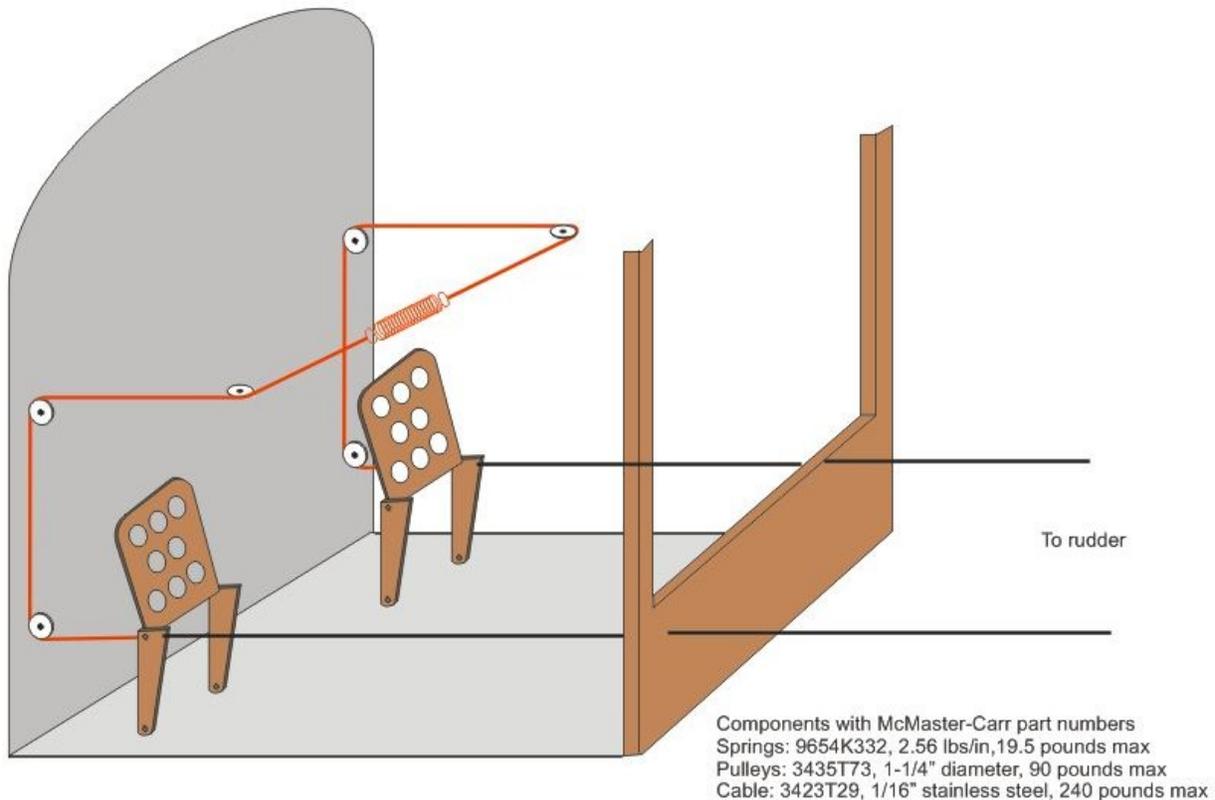


Electric flaps:

The stock flap actuator weldment has a lateral tube behind the seat, two arms that go aft and, an actuating handle that goes forward next to the pilot's left leg. Linkages extend down from the arms to the flaps and pulling up on the actuating bar lowers the flaps. N3NU's weldment has no actuating handle. An electric actuator mounted between the seat bulkhead and the left arm pushes the arm down to lower the flaps. The flap control switch is on the stick.

Electric trim:

Stock trim is manual; N3NU has electric pitch trim with the servo mounted in the left elevator.



Spring-bias rudder trim (original design):

Unlike some other RVs, the RV-3 has significant roll coupling. So, if the ball is not centered, the wings will not be level in straight flight. A fixed trim tab on the trailing edge of the rudder compensates but its effectiveness varies with speed and it cannot be adjusted in flight.

N3NU has a system of cables, pulleys, and springs that can allow the rudder to be trimmed in flight.

NOTE: The system as drawn above is installed today and is the second of two designs. The first had separate springs on each side and varying the tension on one side moved the rudder a bit. But, I found that it took a lot of tension to center the ball, required tension varied with airspeed, and unequal tension affected ground handling. So, I added 4"-high trim wedge of the rudder which centered the ball in at 140 KIAS and modified the system so it placed equal tension on both rudder pedals. I have yet to install a mechanism to create unequal tension. It would be easy but the wedge works so I may never do it.
 JLN/08/07/11



Forward storage compartment and avionics bay (original design):

Early RV-3's had a single fuel tank mounted in the forward fuselage above the pilot's chins. Later RV-3's have fuel tanks in the wings which freed up a lot of space between the firewall and panel. Some builders have used this space for a horizontal electronics shelf supported by the longerons. All stock RV-3 have a tip-over canopy and removable top-forward skin that makes the rear of the panel, forward floor, and a shelf very accessible.

Because N3NU would have a sliding canopy with a fixed windscreen, the idea of a single, removable forward skin was unwelcome. But, even with the forward skin fixed there was still a large, open area forward of the windscreen. In this area, N3NU has a 14-inch long door.



The door opens to a 14-inch deep, 1.75 cubic foot storage compartment with a 25-pound capacity.

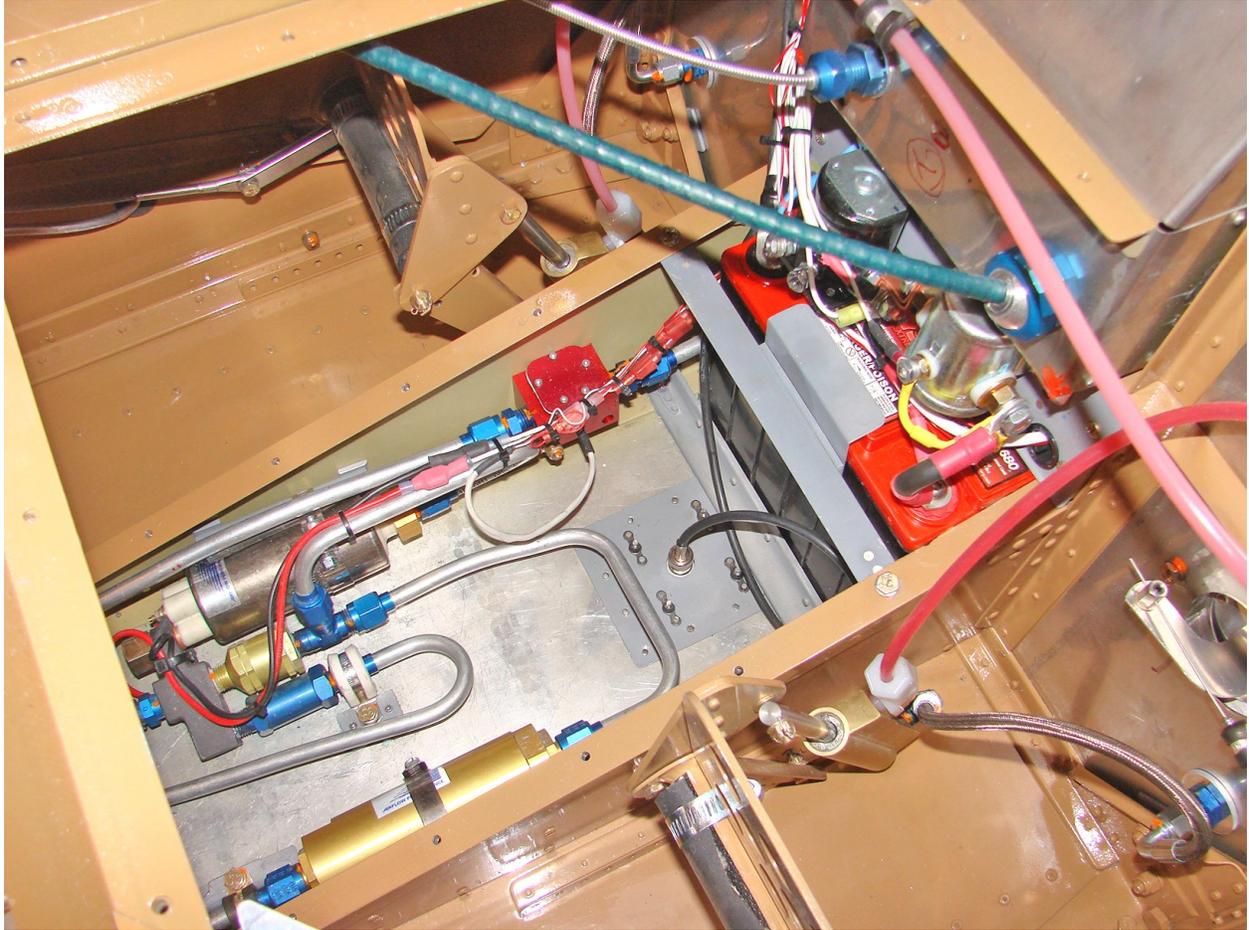




Panel and avionics access:

The aft end of the compartment has a fixed, lateral bulkhead with a door that swings down to expose the back of the panel. The 8-inch space between the bulkhead and the panel is enough for all panel-mounted instruments and avionics except the forward end of the transponder.

A removable, longitudinal bulkhead at the back of the compartment separates it from an 8-inch deep avionics bay that runs from the firewall to the lateral bulkhead. The control unit for the VP-X and the GRT EFIS AHRS, GPS receiver, EIS manifold pressure transducer, and XM weather receiver are in this bay as well as the end of the transponder.



Floor and lower firewall access:

The longitudinal bulkhead and floors of both the storage compartment and avionics bay are removable through the outside door. However, just removing the storage compartment's floor provides excellent access to the aft face of the lower firewall where the battery and contactors, rudder pedals and brake master cylinders, and fuel selector valve and lines are located



Sliding canopy (scratch-built, original design):

The stock canopy design is a one-piece Plexiglas bubble fastened to an aluminum frame that hinges on a longeron. Van's provides plans for a slider option but no other support and certainly no parts. The plans show the windscreen-slider seam perpendicular to the longerons, and the canopy slides on the longerons and on "towel-rack" looking arrangement fastened to the top center of the fuselage.

The center of N3NU's canopy slides on a track fastened directly to the fuselage skin like that found on an RV-8. To hold the canopy down when it is closed, three pins in the canopy frame engage a UHMW block just behind the seat and two pieces of aluminum angle further back on the top of the fuselage.



The scratch-built windscreen bow and canopy frame are welded 4130 steel tubing and the canopy skirt is fiberglass.



N3NU's windscreen-canopy seam is raked back 14° making the windscreen bigger and cockpit access easier.



Cockpit storage—left side (original design):

No flap actuating handle on the cockpit's left side allows room for a custom cockpit side console with an arm rest and two storage compartments aft of the throttle quadrant.

Modified throttle quadrant:

Van's 3-lever throttle quadrant comes with parts that placed the engine controls so far aft that there was limited elbow room. N3NU throttle quadrant is 3" further forward. The throttle lever has a PTT button.



Cockpit storage - right side (original design):

The right side is a mirror image of the left side but has a third, covered compartment in place of the throttle quadrant.



Cockpit storage - center (original design):

There is more open storage forward of the spar.

Hands-on controls:

- Throttle - PTT
- Stick - PTT, pitch trim, flaps, CWS, radio flip-flop (2), and EFIS heading sync

Other controls:

Except for the stick, engine controls, tank selector valve and knobs for three Bowden cables, no switches or other controls are below the panel or aft of the spar.

Reshaped rudder top and bottom (slight changes):

The stock top of the vertical stabilizer and rudder slope downward slightly while N3NU's are parallel with the fuselage datum, the main longerons. The bottom of N3NU's rudder has a mount for a tail navigation/strobe light in a different location than the fiberglass fairing provided by Van's.

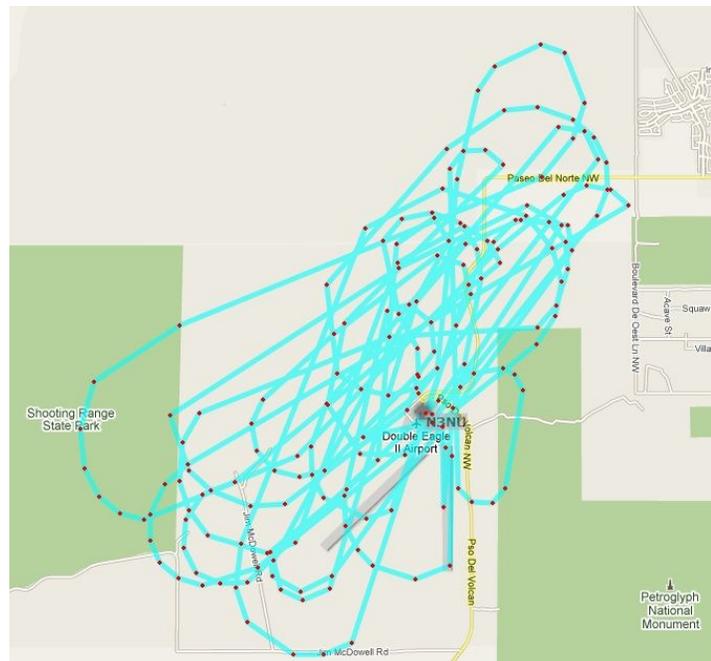
Vertical stabilizer offset:

Plans show the vertical stabilizer mounted on the fuselage center line. But, the front of the N3NU's vertical stabilizer is 0.2" left of center which helps center the ball at cruise speed.

Automatic Packet Reporting System (APRS)

The APRS ham-band transmitter is under the seat pan, two LEDs are on the panel to show GPS status and when the system transmits, and a scratch-built antenna is at the top of the vertical stabilizer.

N3NU's ground track may be viewed in real time on the internet (APRS.FI/?call=n3nu). The track from N3NU's first flight on 11 December 2009 is shown here.



Custom fiberglass layups

N3NU has 31 custom fiberglass layups: 2 very small, 18 small, and 11 large. The list below groups the projects large to small.

Canopy skirt — 1 piece (shown on page 12)

Cowl extensions— 2 pieces (shown below)

Wing-fuselage fairings — 6 pieces (shown below)

Tail fairings — 3 pieces (shown below)

Canopy bow — 1 piece

Gear intersection fairings — 6 pieces (upper shown below)

Cowl exhaust exits — 2 pieces

Tail tips — 6 pieces

Wing-tip light mounts — 2 pieces (shown below)

Covers for cowl wires — 2 pieces

