

I Want to Build My Own Airplane

Part 10: Cockpit Layout

"I'm about 90% done and have about 50% to go!"

We've heard this and we've said it because once the tail feathers, the wings, and the fuselage structure is completed, we should be near the end of our construction time, right? And then it seems to take forever to complete all the remaining items; engine installation, control systems, instrument panel, cockpit controls and layout. However, this is also a most rewarding building phase because it allows us our own free will at innovation; an opportunity to put our own individual stamp on our aircraft. But where and when do we innovate and when do we stay with established standards?

In this column, let's look at the cockpit layout. With permission, I have borrowed heavily from Dr. Ed Wishmeyer in his paper prepared for EAA's Homebuilt Aircraft Council.

It makes perfect sense to standardize our cockpit layout of controls and instruments. Standardization will decrease the chance of an accident by inadvertent incorrect control input. For example, you would not want to reverse the up or down elevator or the right and left aileron control movement relative to stick input. So there are places where innovation is appropriate, but others where it is not. Cockpit design standardization is important; for one's own safety, to minimize liability, to improve resale value of the aircraft, and to protect the safety record of amateur-built aircraft in general.

So let's look at some simple established standard precepts:

Flight Control Safety:

Control system linkages should be such that loose items in the cockpit cannot fall into a spot that would jam the controls.

Flap deflection should be displayed by visual markings on the flaps (visible at night), by manual flap handle, or by a flap position indicator on the instrument panel.

Colour of Controls:

Only emergency controls should be red and marked as to the method of operation.

Marking, Labels, Placards:

All controls except the primary flight controls should be plainly marked. This includes fuel selectors and unusable fuel for each tank on the selector, or on the fuel gauge.

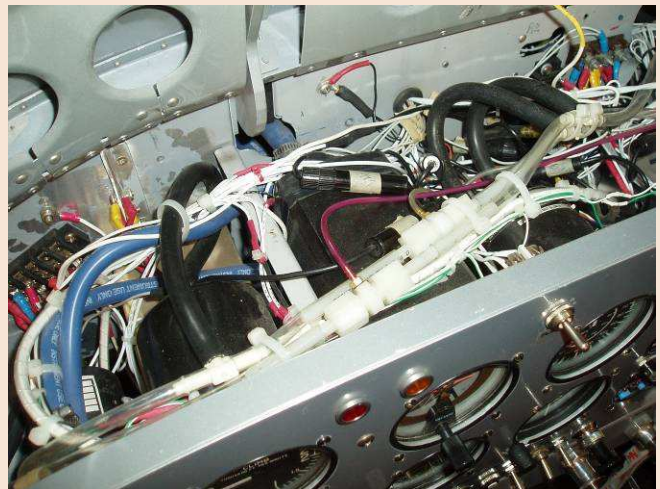
On or near the airspeed indicator, the V_a (operating maneuvering speed) should be clearly marked. Similarly the flap and gear deployment speeds.

Every electrical switch should be labeled. Electrical switches should be laid out in groupings so that the possibility of inadvertent operation is reduced or eliminated. For example, you may want to place the 'fuel-pump' switch away from the 'Master' so that you do not inadvertently turn off the 'Master' instead of the 'Fuel Pump'.

Control Positions and Locations:

The 'Master Switch' should be easily discernable and accessible. It is often coloured red and located at the end of a row of switches to make it easy to find.

The standard layout for flight control 'steam' gauges is as follows: 'Airspeed' on the left, 'Altimeter' on the right. The 'Attitude Gyro' is centered and the 'Directional Gyro', or 'HSI' (Horizontal Situation Indicator) directly below the attitude gyro. In some aircraft kits the standard location of gauges can be difficult to attain because of the instrument and bulkhead structures.



In the Van's tip-up canopy, a secondary bulkhead is close to the instrument panel, and frequently gauges need to extend through cutouts made in this second

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dary bulkhead. These cutouts need to be placed in locations and in a manner that does not interfere with the structural intent of the bulkhead. Makes a good case for the shallower 'glass cockpit' instruments doesn't it? (See Ralph's Panel article, Page 3)

The order for the power levers are, from left to right, 'Throttle', 'Prop', 'Mixture'. The throttle should be at least an inch longer than the other controls and the mixture control should be red.

'Carburetor Heat', or 'Alternate Air' levers should be to the left of the throttle or at least 8 inches away from the mixture control. The 'Supercharger' control should be below or aft of the propeller control if on a pedestal.

'Wing Flap' and auxiliary lift device controls should be located centrally or to the right of the pedestal or power control centerline. The 'Landing Gear' control should be located to the left of the throttle centerline or power control pedestal. It should be far enough away to avoid any confusion between it and the flap deployment control.

'Fuel Selectors' should be visible and reachable without moving the seat or any other flight control. Mechanical fuel selectors should have noticeable detents and their handles should be so shaped and installed as to ensure no confusion as to which tank is being selected.

Control Movement and Operation:

Controls should move forward for: increased thrust, increased propeller RPM, richer mixture, and fuel on.

Rotary controls should move clockwise for increase or from 'off' to 'full on'.

Landing gear switch: down to extend gear.

Trim: switch motion or mechanical rotation of control to produce a similar rotation of the axis of the aircraft about an axis parallel to the axis control.

Control Knob Shape:

Throttle, prop, and mixture control knobs must be of a standard shape. (see photo) Although colour is not mandatory, a good practice is for the throttle to be black,



the prop blue, and the mixture, red. It is permissible to use a vernier control for the prop and mixture controls, but you should not use one for the throttle control.

Instrument Installation Comments:

Consider the following suggestions:

- You should provide positive drainage for both the pitot and static systems.
- Magnetic compass deviation in flight should not exceed 10 degrees
- If an engine gauge is driven directly with flammable fluids under pressure, there should be a restrictive orifice to prevent excessive fluid loss if the line fails.
- Visible fuel sight gauges should be protected against damage and freezing.
- Fuel gauges should register zero when all **useable** fuel is exhausted.
- The airspeed indicator should be marked with the appropriate and familiar white, green, yellow and red arcs.
- Engine instruments should be marked with their normal operating ranges.

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And Finally some Additional Thoughts:



Your 'Master' switch and your 'Fuel Pump' switch are the only switches that may be red. All others switches may not be red.

Some switches are 'safe' such as 'Navigation Lights',

where inadvertent operation does not require immediate correction. Others like 'Mixture', 'Ignition', or 'Avionics Master' are not. Therefore it's a good idea to keep the 'not safe' switches separated from the 'safe' ones, either by distance or by knob type.

Switches that might be needed in a hurry such as 'Carb Heat' or 'Fuel Pump' should be easy to find, perhaps in an open space with no similar switches near by.

Control Stick Buttons: Be careful of what control switches you place on the control stick. Some like 'Pitch Trim' or 'Push-to-talk' might be appropriate. Others like 'Flaps' or 'Starter' might be inappropriate since their inadvertent operation could create a flight hazard or damage equipment.

Due diligence, considering standard, proven design when laying out your controls and instrument panel, will pay dividends to safety in control operations, as well as to the value to your homebuilt. Keep it simple and keep it 'standard'.

Jack Dueck, EAAHAC

Meteorology Course: News Announcement:

Here is the latest we have from Ken Grandia:

He is proposing 2 separate courses, with a limit of 15 per course. Suggested dates are Oct 21 and 28 for Course 1, and the second on Nov 18 and 25. Both courses run from 0900 to 1300 h. Provisions can be made for those in the first class to make up missed dates on the second class. If desired, the 2nd class could be delayed until after New Years.

The price for members is \$100 (\$125 for non members), including textbooks.

Ken suggests that we try to sign up enough members on Oct 5 to commit to the class and get enough deposits to order the textbooks.

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