Rob Housman

From: Rob Housman [RobH@hyperion-ef.com]

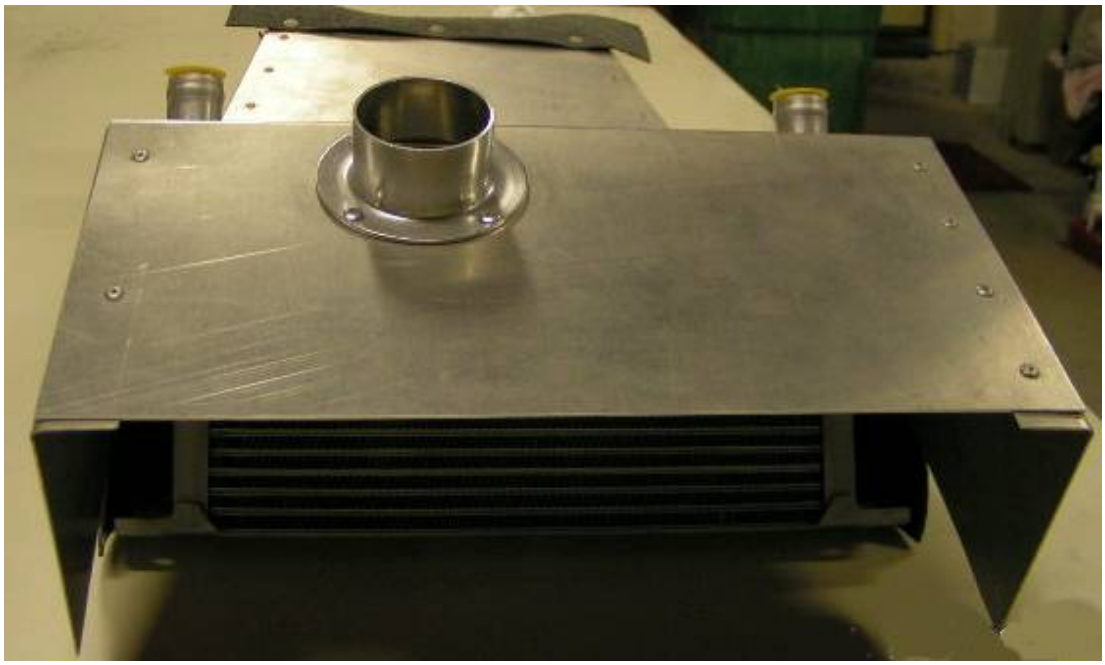
Sent: Tuesday, January 13, 2004 8:49 AM

To: Craig Ellison; John Cliff; Paul Mansfield; Fergus Kyle; paul.mcallister@qia.net; Jeff Roberts; gnholland@onetel.com

Subject: Cabin air & heat

My primary objection to the heater boxes available from the usual aviation supply shops is that they are all fabricated from aluminum (melting point around 660ºC) and therefore provide essentially no protection from fire on the engine side of the firewall (and they all require a huge hole in the firewall in order to get any reasonable volume of air into the cabin – to me that looks entirely too much like a potential blow torch). The arrangement shown here should provide sufficient protection..

Here are the details. The warm air intake is just behind the oil and air coolers as shown in the first two photos below. The flap is similar to the flap the factory uses to direct cool air onto the turbo on the Rotax 914 (that flap is of course forward of the coolers, and is not visible in these pictures). The 2 inch diameter flange is Aircraft Spruce part number 10350-8; four pop-rivets hold the flange to CD1.



The two plenum chambers are made from aluminum chassis boxes (normally used for electronic projects). These are available in a variety of sizes and shapes from various electronics supply shops. Here I have used a small box for the warm air plenum and a larger one for the mixing plenum primarily to get things to fit. My original scheme was to use a single box but because I designed the system after too many other things were in place I did not have room for a single plenum.

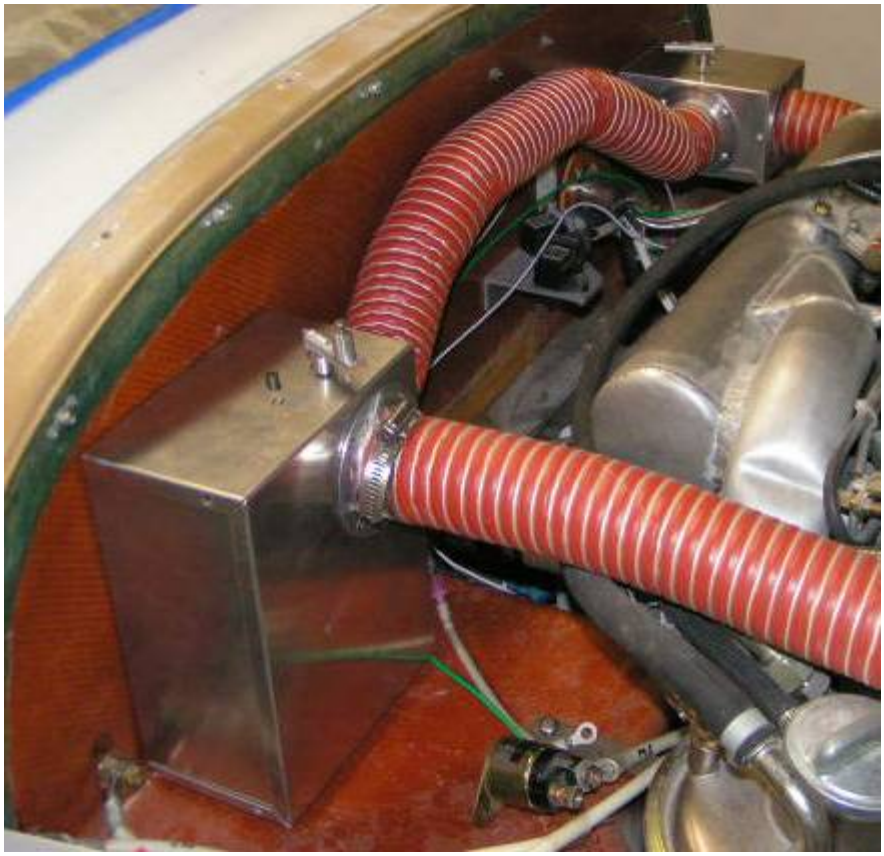
The butterfly valve shown here is fabricated from aluminum sheet, aluminum rod, the same ACS flange, and bushings and bearings from McMaster-Carr (my source for all miscellaneous hardware not available from ACS - details on request). There may be something equivalent available off-the-shelf but I was not able to find anything suitable. The other box has an identical butterfly valve. The duct from the fresh air source attaches to the opposite side of this piece.

Below is the other “half” of the mixing plenum showing the firewall pass through with it’s “fire door.” The fire door, and the same size metal piece attached to the firewall, are stainless steel, and the aluminum box is cut out around the stainless steel piece attached to the firewall. The door is held open by a fusible link (the brass part is actually two pieces of brass soldered together with a low melting point solder) and the stainless steel hinge (which is not visible) has an integral spring to snap the door shut if the fusible link comes apart. The main advantage to this fire door arrangement is that it requires no action in the event of a fire forward of the firewall – once the temperature is high enough to melt the fusible link (212ºF/100ºC McMaster-Carr part number 1147A14) the door slams shut. I chose the temperature somewhat arbitrarily because I do not know the normal temperature inside the cowl on a hot day – a lower value may work but I chose a the highest value available to avoid nuisance closing of the fire door. It is easy enough to replace the fusible link at any time.

The firewall pass through includes a 1.5 inch diameter flange (ACS p/n 10350-6) on the cabin side. This flange is located inside the cavity formed by the panel molding's shelf on the starboard side of the panel, and the 1.5 inch diameter SCAT tube (ACS p/n 05-26606-6) snakes through this cavity to the eyeball vents on the panel. Since this is a work in progress I have not yet installed these vents, but my plan is to have one on the avionics panel and another on the top of the glareshield to de-mist the windscreen. A white wire is visible through the flange but that is not part of the scheme (and since the wiring is also still unfinished some is hanging loose). Note that the fixed piece of stainless steel covers the flush aluminum pop rivets that hold the flange in place, and that piece is attached with flush steel pop rivets, thus maintaining the integrity of the firewall.

The picture below shows the almost complete installation. Not yet installed are the Bowden cables (ACS p/n 05-14200) that operate the butterfly valves. These cables pass through the firewall along with the electrical wires (barely visible next to the warm air plenum) so no additional firewall penetration was necessary. The 2 inch diameter SCAT tube (ACS p/n 05-29908-8) exiting the picture at the lower right, bends down just forward of the oil reservoir and connects to the top of the turbo air inlet plenum.

The shaft of the butterfly valve is activated by a crank (fabricated from aluminum rod) connected to the Bowden cable. Not yet installed is the fixed mount for the end of the cable sheath – this will be mounted on the top of the box.



Best regards,

Rob Housman
Europa XS Tri-Gear A070
Airframe complete
Irvine, CA