Airbrake Proposal

To expedite matters and allow a foam mock-up to be made I have detailed the key elements of the aero shape. There should be enough detail to create a workable first pass. I still have to run the stress calculations but having run through them previously at the moment I do not envisage an issue.

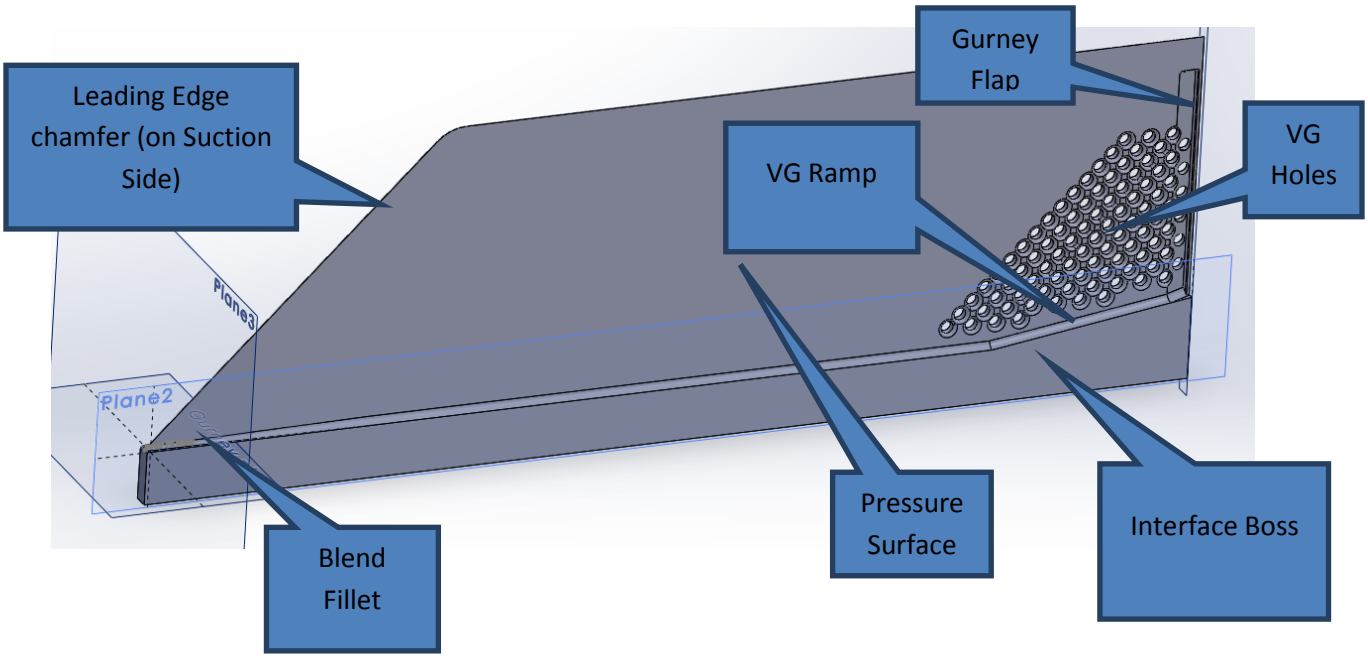


Figure 1

Nomenclature.

General concept.

The endplates want to be attached at an angle as if an extension of the airbrake edges see Figure 2. The Pressure Surface side (PS) to be facing inwards towards the centreline of the airbrake. The endplates want to attach to the sides of the airbrake. The interface boss is simply a pictorial representation of the need to extend as each side is different. Essentially the thickness of the boss is taken from the width of the airbrake so that the span remains the same. 10mm thick was chosen so that larger endplates may be used later if required. The boss would fit to the endplate with a tongue and groove arrangement. The joint is likely to be a tongue and groove (T&G) so that they may be tuned if required see Figure 3. Because of the depth of section of the airbrake in the side regions the T&G detail will be thicker than this initial sketch shows.

The blend fillet need to taper at the front or be hand dressed do that there isn't a step presented to the airflow. The exact shape is not super critical as it is we within the boundary layer of the car.

The leading edge chamfer could be hand dressed if machining is too difficult. It's a compromise between an ideal knife edge and in service robustness.

The radii around the Gurney Flap can go to 2mm if 1mm is a problem.

New shaped vortex generators are shown in Figure 4. There are three of these and they virtually occupy all if the rear chord, see Figure 5. One is located down the centreline of the airbrake and the others equi-spaced either side. There is only a millimetre or so clearance per VG. These are in ramp configuration, turn them around and they are plough configuration. The difference is whether they induce up wash or downwash and as yet we don't know what is best for the Invader. So if you put three holes per VG in the airbrake then they can be turned around. They should fit equi-spaced along the trailing edge of the airbrake. There may also be a requirement to make them taller. Because the shape may change and the airbrake is curved I would initially get them to fit but liquid shimming the underside. Liquid shim is simple using an epoxy adhesive or a metal loaded on such as Devcon one puts under the face, clamps it up allows the excess to squeeze out and then one set dressed so that the contour is captured. Obviously one needs to release the bolts and the airbrake surface so that the liquid shim doesn't just bond the VG into position.

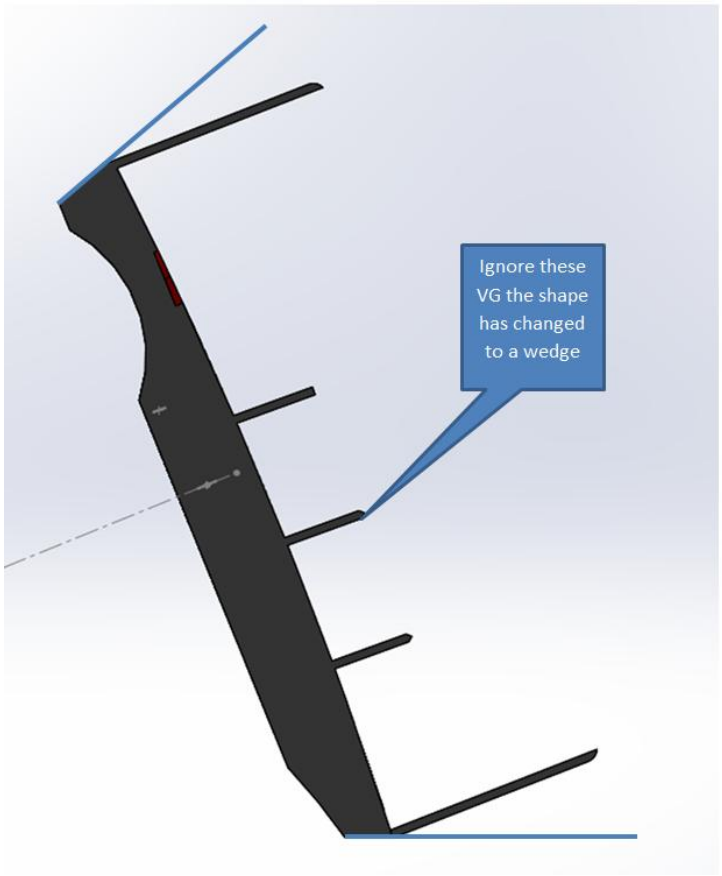


Figure 2

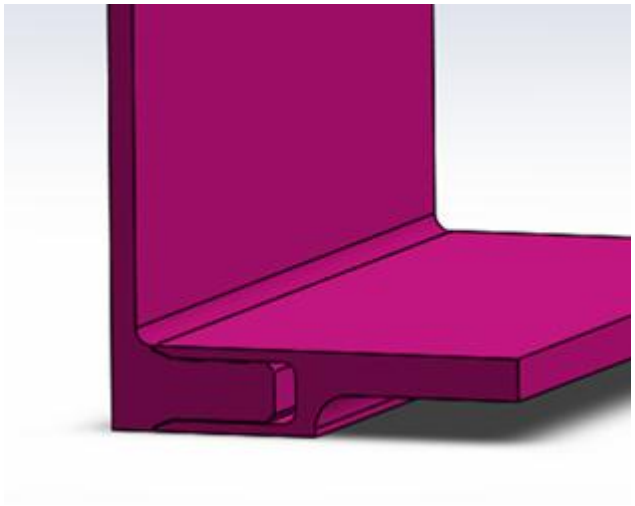


Figure 3

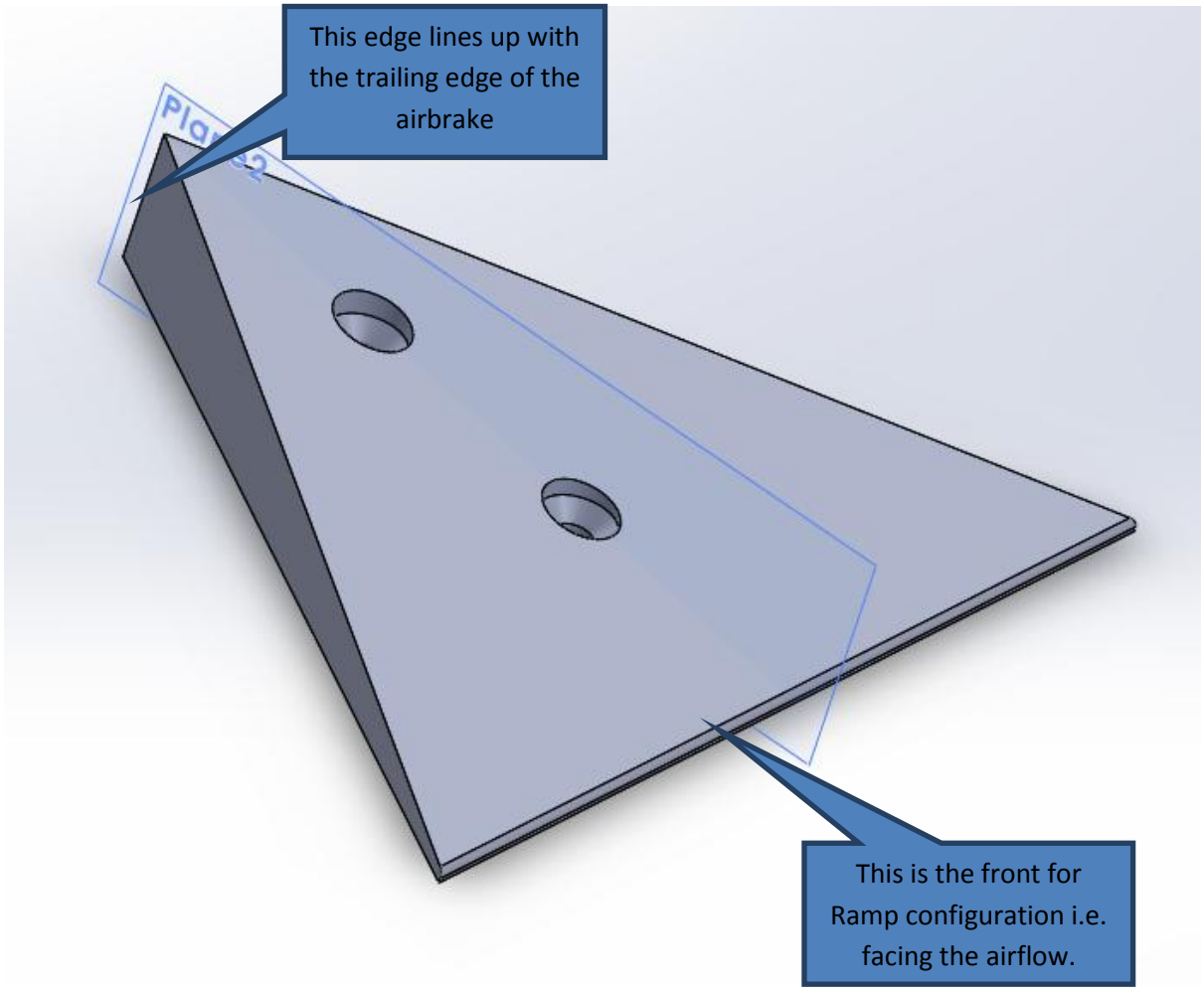


Figure 4

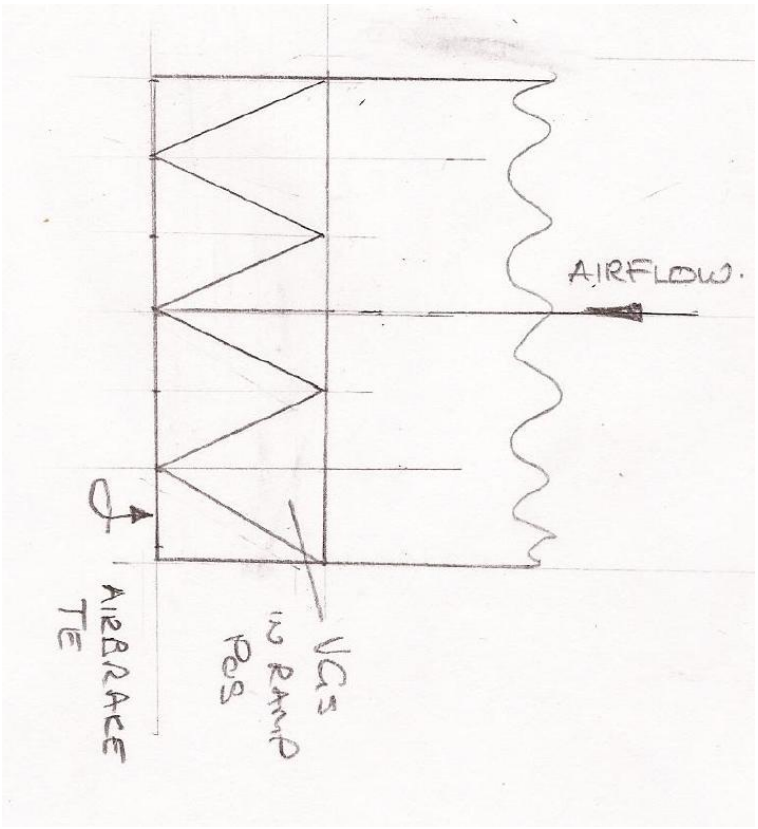
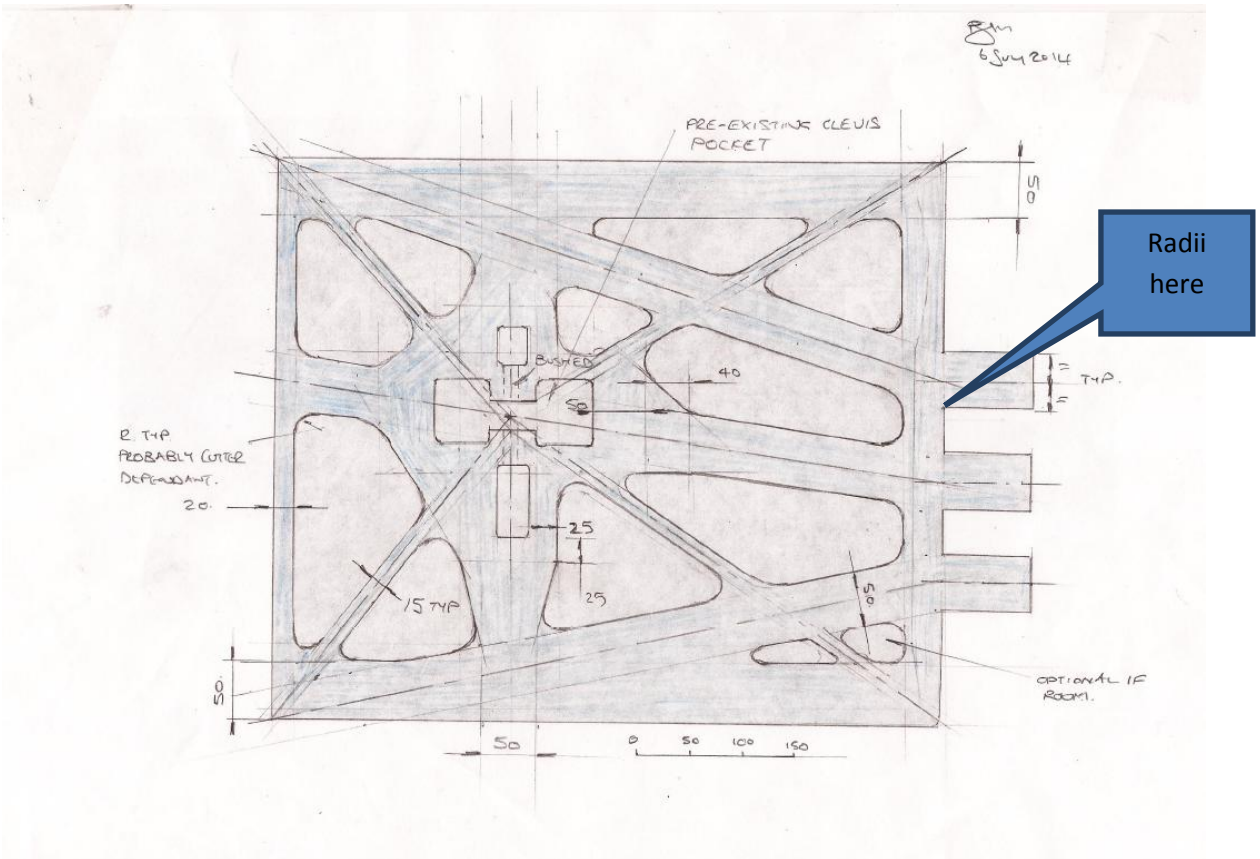

AIRFLOW.
AIRBRACE
TE
VGs
IN RAND
POS

Figure 5


6 JUN 2014
PRE-EXISTING CLEVIS
POCKET
50
Radii
here
BUSHED
40
TYP.
R TYP
PROBABLY CUTTER
DEPENDANT.
20.
25
25
15 TYP
50
50
OPTIONAL IF
ROOM.
50
0
50
100
150

Reverse side pocketing is shown above as per previous sketch. Fillet radii in the hinge boss corners will help reduce stress concentration factors. The rebate for the clevis actuator pin will need to be bushed. The forces here will be negative when the airbrake is stowed and positive when deployed. Assume initially that the negative force when stowed is 25 kN. Basically the airflow will want to such the airbrake open initially. It is assumed that the facing material, i.e. the side seen by the airflow is nominally 10mm thick 7075 T6 or similar.