1. Current Design:

Hole diameter, $D = 0.004572$ m
Fuselage radius, $R_F = 1.905$ m
Skin thickness, $t_s = 0.000762$ m
Fuselage pressure, $p = 0.0586$ MPa
Crack length, $a = 0.004$ m
Hole spacing, $s = 0.0254$ m
$A_1 = 0.935$
$A_2 = 0.000344$ m
$A_3 = 0.000472$ m

Using the stress formula given in the problem statement,

$$\sigma_m = \frac{A_1 pR_F}{t_s} = \frac{0.935 \times 0.0586 \times (1.905)}{0.000762} = 136.98 \text{ MPa}$$

$$P = \frac{A_2 pR_F s}{t_s} = \frac{0.000344 \times 0.0586 \times 1.905 \times 0.0254}{0.000762} = 0.00128 \text{ MN}$$

$$\sigma_p \overset{\text{def}}{=} \frac{P}{t_s s} = \frac{0.00128}{0.000762 \times 0.0254} = 66.14 \text{ MPa}$$

$$\sigma_b = \frac{A_3 pR_F}{t_s^2} = \frac{0.000472 \times 0.0586 \times 1.905}{(0.000762)^2} = 90.75 \text{ MPa}$$

Also,

$$a_{eff} = 0.004 + \frac{1}{2} \times 0.004572 = 0.006286 \text{ m}$$

Hence,

$$\overline{\beta} = 0.39 \left[1 + 0.16 \left(\frac{a_{eff}}{s} \right)^2 \right] \frac{\sigma_b}{\sigma_m} + \sqrt{\sec \left(\frac{\pi a_{eff}}{s} \right)} \left(1 - \frac{1}{2} \frac{\sigma_p}{\sigma_m} \right) + \frac{1}{2} \frac{s}{\pi a_{eff}} \frac{\sigma_p}{\sigma_m} = 1.47$$

$$\boxed{K_I = 1.47 \times 136.98 \sqrt{\pi \times 0.006286} = 28.3 \text{ MPa}\sqrt{m}} \quad < K_{Ic} = 40 \text{ MPa}\sqrt{m}$$

Hence, the cracks will <u>not</u> propagate for the current design under the given loading condition. The factor of safety for the current design is

$$\boxed{\text{Factor of Safety} = \frac{K_{Ic}}{K_I} = \frac{40}{28.3} = 1.41}$$