From NASA TP-2000-209760, "Oxidation of Reinforced Carbon-Carbon Subject to Hypervelocity Impact", by Curry et al., 2000.

Assessment of an entry environment using the methodology developed begins with a thermal entry analysis for the entire RCC leading edge subsystem. A typical International Space Station (ISS) Shuttle mission trajectory case R, 233K forward cg with 57 deg inclination was chosen. Figure 22 presents the temperature histories that represent the entire wing leading edge. For this assessment of the RCC wing leading edge areas where temperatures are predicted to be below 2800°F, the hole growth is not expected to expand beyond the coating damage surrounding the impacted hole. An examination of RCC temperatures reveal that only panels 8, 9, and 10 stagnation area would experience entry temperatures above 2800°F where major coating erosion would be predicted. The entry environment for panel 9 stagnation area is presented in figure 23.

The assessment of the impact damage area of the wing leading edge panel requires the prediction of the expected hole growth history. This hole growth history is used to evaluate the consequences of the potential damage effects to the Orbiter structure. For this example a 0.25-in.-dia. hole resulting from MOD impact was assumed. Figure 24 presents the predicted hole growth history for the ISS Case R trajectory. The back hole growth rate is used to calculate the hot gas influx into the wing leading edge cavity for assessing wing spar insulation and structural damage. Final hole diameter of 1.76 and 1.415 in., respectively, for the front and back surfaces is predicted.

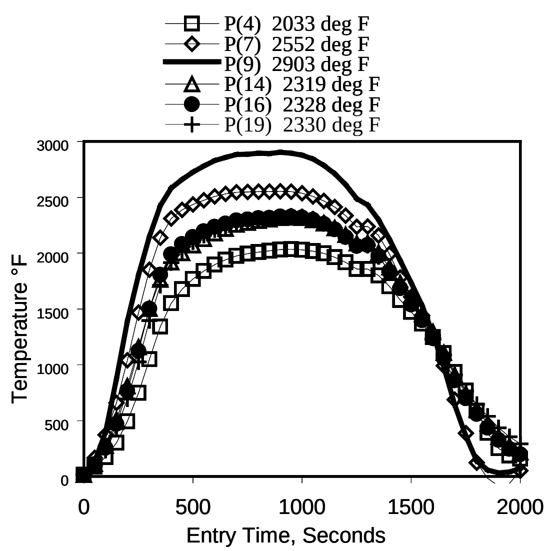

Figure 22. Temperature histories for the stagnation area of the wing leading edge panels 4, 7, 9, 14, 16, and 19 for the ISS mission case R 233K, 57-deg inclination entry trajectory.

1 Btu/ft^2 = 11.35 kJ/m^2.
So 40 Btu/ft^2-sec = 454 kW/m^2.

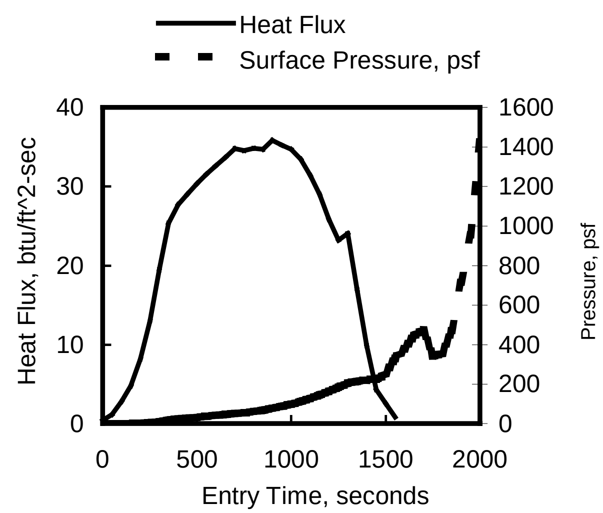

Figure 23. Heat flux and pressure history for the stagnation area of the wing leading edge panels 9 ISS mission case R 233K, 57-deg inclination entry trajectory.