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22 April 1993

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Subject: Surface Panel Thermal Characteristics

By irradiating an antenna panel sample with IR I have measured the thermal characteristics. The figure shows the following temperature differences:

1] Average of front and back of panel - ambient room temperature.

2] Front - back of panel

3] Back panel - temperature of probe box

vs IR flux. (The IR flux level was calibrated by heating water in a paper cup and measuring the rate of temperature rise.) The flux scale is consistent with an IR absorbtivity of 70% - assuming a panel conductivity of 100 $wm^{-2}K^{-1}$. On the assumption of an absorbtivity of 70% the heat loss inferred from the panel-ambient is 29 $wm^{-2}K^{-1}$ of which 7 $wm^{-2}K^{-1}$ must be radiative (Stefan-Boltzmann is 5 $wm^{-2}K^{-1}$ per side for perfect emitter) leaving 11 $wm^{-2}K^{-1}$ per side convective loss.

<u>How do these measurements relate to the antenna?</u>

Based on the near perfect IR emissivity of the radome, the IR flux from the dome is

$$5\ wm^{-2}K^{-1}\ per\ side$$

Thus for a 20°C rise in temperature of the radome material the IR flux is 100 $wm^{-2}K^{-1}$ and one might expect a 0.7°C temperature difference across the panels and a further 0.35°C drop in the temperature actually measured by an uninsulated "probe box". The probe boxes on the back side of the antenna being biased 0.5°C low compared with the center of the antenna panel. On a clear night the situation is likely reversed and the probe boxes will now be biased high so that the day/night bias is expected to be about 1°C. Simply insulating the probe boxes should reduce the day/night bias to 0.7°C and averaging probe boxes on both sides of the panels should eliminate the bias altogether.

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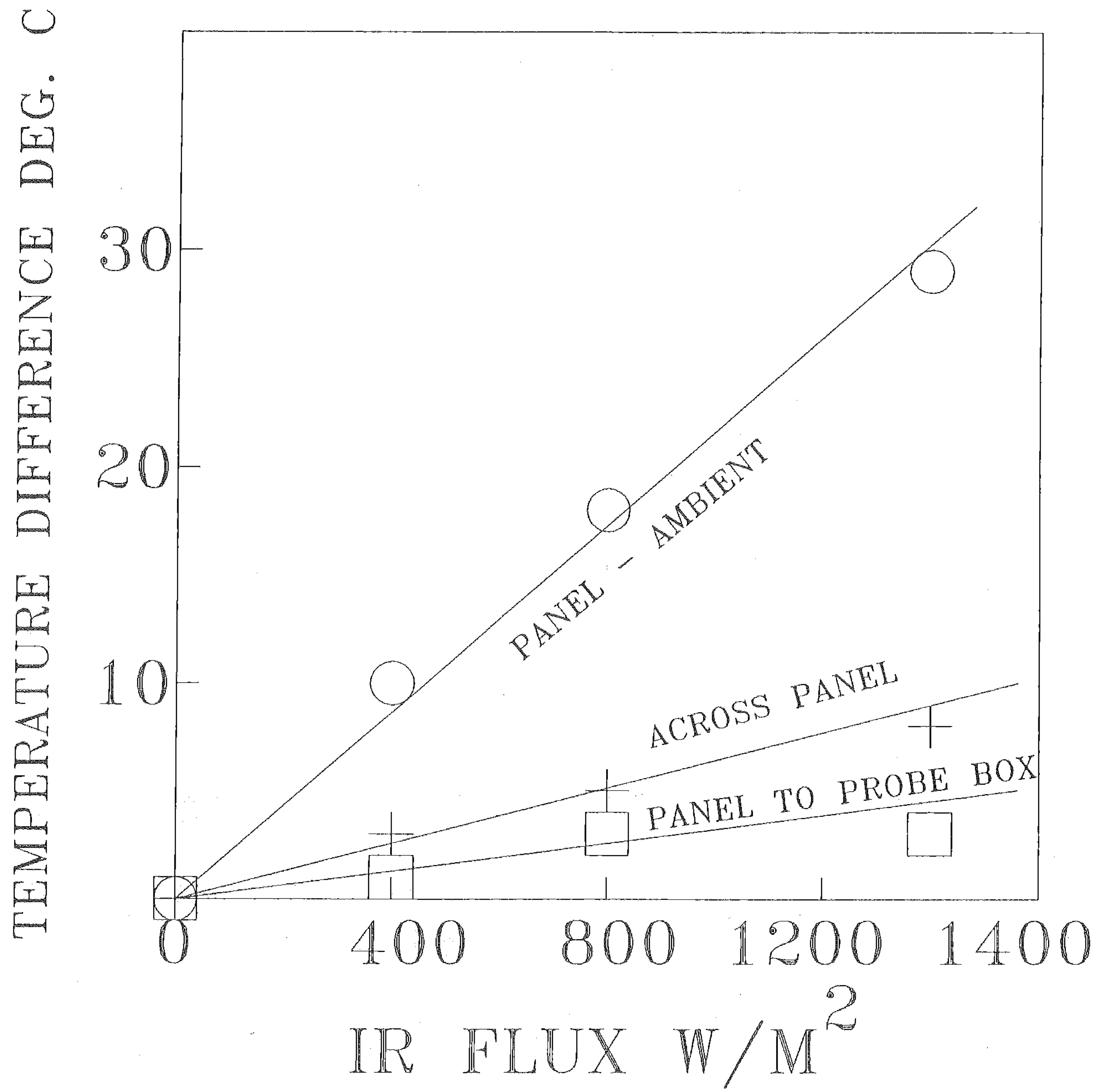

Fig. Panel thermal characteristics