

Compact Two-Band Thermographer for Remote Measurement of Skin Temperature – Phase II Summary

The United States Marine Corps (USMC) and the United States Air Force (USAF) require an accurate remote infrared (IR) thermographer as a feedback mechanism for their Active Denial System (ADS). The ADS is a non-lethal weapon technology which employs microwave radiation as directed energy to heat the skin of an advancing adversary; the result is a non-injurious incapacitating effect which can be immediately terminated upon retreat of the adversary. When used with the two-band thermographer to directly monitor the skin temperature over a large standoff range, the ADS may not only provide a safer and better controlled alternative to rubber bullets, high pressure water denial, and tear gas, but it also may be employed over a considerably larger range of weather conditions.

OPTRA has successfully demonstrated a prototype IR thermographer system tailored to this particular application. Our system uses a spectral measurement technique to effectively determine the color temperature of the skin as opposed to a typical integrated radiance measurement approach. Our system employs two miniature uncooled microbolometer cameras which operate over different spectral bands in the 8 to 13 μm region. A normalized algebraic combination of the two spectral channels on a per pixel basis provides an accurate temperature measurement which is independent of attenuation due to rain, humidity, and mild fog. We have also added an internal radiance calibration capability which allows the system to correct for its own changing temperature over time. The optical system supports a spatial resolution of 23 cm at a 700 m standoff and also includes an on-axis, wide field of view visible (VIS) imager to aid in pointing and overall user-friendliness. The graphical user interface (GUI) provides a fused VIS/IR image to the user with the temperature information conveyed in false color. The temperature resolution is better than $\pm 1^\circ\text{C}$, and the accuracy at the 700 m standoff is $\pm 2.5^\circ\text{C}$ at a 15 Hz frame rate. Below is a photograph of the final thermographer system.

Prototype of Compact Two-Band Thermographer

