Development of a Wet Bulb Globe Temperature Approximation Equation from Standard Meteorological Variables and Implementation of an Automated Site Specific Heat Stress Condition Display at the Eglin Test and Training Complex

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An automated heat stress display system is currently utilized at the Eglin Test and Training Complex (ETTC) to provide timely and site specific heat stress information in a dynamic Florida Panhandle summer weather regime. This automated system uses a Wet Bulb Globe Temperature (WBGT) formula which was developed to approximate WBGT values using solar elevation angle and standard meteorological measurements from existing weather observing sensor systems at 16 sites across the ETTC. The formula is used to produce an automated algorithm to calculate site specific WBGT values and to disseminate the corresponding heat stress condition for each site on the ETTC, with updates available every ten minutes. The WBGT heat stress index, developed in the 1950's, is commonly used by the United States military and other organizations that require personnel to work in hot and humid environments. WBGT values correspond to well-established work/rest cycles and hydration recommendations in order to allow supervisors and workers to mitigate the risk of heat related injuries.

Traditionally, WBGT is calculated based on measurements of dry bulb temperature, natural wet bulb temperature, and black globe temperature. The dry bulb temperature is the ambient air temperature, and is a routinely measured quantity. The natural wet bulb and black globe temperatures are not routinely measured quantities, and require specialized sensors. At most United States Air Force (USAF) installations, personnel responsible for taking WBGT measurements commonly use a specialized device which measures the three types of required temperature values to calculate the WBGT value at a single point. At a large military installation such as the ETTC, with work sites spread across 724 square miles, a WBGT measurement at a single point taken once (or less) per hour fails to detect the spatial and temporal changes in heat stress across the range. Utilizing multiple WBGT sensors to obtain representative measurements across the ETTC is cost prohibitive due to the additional equipment, manpower, maintenance, and training required to take additional measurements. Therefore, this automated heat stress display system at the ETTC which utilizes regularly measured meteorological variables provides improved temporal and spatial resolution of critical heat stress data to personnel working

outdoors and managers during the ETTC's hot and humid summer and saves significant manpower, training, and equipment costs. This presentation describes the development of the WBGT estimation equation and implementation strategies at ETTC.