ARL-TR-7347 ● July 2015

US Army Research Laboratory

Hot Environment Assessment Tool (HEAT) User's Guide for Apple Mobile Devices

by David Sauter

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ARL-TR-7347 ● JULY 2015

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Hot Environment Assessment Tool (HEAT) User's Guide for Apple Mobile Devices

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REPORT DOCUMENTATION PAGE	*Form Approved* *OMB No. 0704-0188*

1. REPORT DATE *(DD-MM-YYYY)* July 2015	**2. REPORT TYPE** Final	**3. DATES COVERED (From - To)** 15 Nov 2014–31 Mar 2015
4. TITLE AND SUBTITLE Hot Environment Assessment Tool (HEAT) User's Guide for Apple Mobile Devices		**5a. CONTRACT NUMBER**
		5b. GRANT NUMBER
		5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S) David Sauter		**5d. PROJECT NUMBER**
		5e. TASK NUMBER
		5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) US Army Research Laboratory ATTN: RDRL-CIE-D White Sands Missile Range, NM 88002-5501		**8. PERFORMING ORGANIZATION REPORT NUMBER** ARL-TR-7347
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)		**10. SPONSOR/MONITOR'S ACRONYM(S)**
		11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; distribution unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

Operations in a hot environment can significantly degrade Soldier effectiveness. The Hot Environment Assessment Tool (HEAT) application provides guidance for work/rest cycles and water intake based on simple user inputs.

15. SUBJECT TERMS

heat stress, Soldier effectiveness

16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON** David Sauter
a. REPORT Unclassified	**b. ABSTRACT** Unclassified	**c. THIS PAGE** Unclassified	UU	16	**19b. TELEPHONE NUMBER (Include area code)** (575) 678-2078

Standard Form 298 (Rev. 8/98)
Prescribed by ANSI Std. Z39.18

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1. Introduction

The Hot Environment Assessment Tool (HEAT) application (from here on also referred to as the "app") provides guidance on work/rest and continuous work times as well as water intake requirements as a function of weather conditions, Soldier work rate, and clothing configuration. It also predicts and displays the Wet Bulb Globe Temperature (WBGT). Output is based directly on the guidance provided in the US Air Force Technical Bulletin (TB), "Heat Stress Control and Heat Casualty Management".[1] The WBGT is computed from meteorological inputs, date/time, and geographic location per formulations found in "Modeling the Wet Bulb Globe Temperature Using Standard Meteorological Measurements".[2] HEAT runs on Apple- and Android-based smartphones and tablets (referred to from here on as the "device").

HEAT was hosted on the device to address the issue of heat stress injuries in the military. A study[3] indicated that annually, there are over 200 injuries requiring hospitalization from heat stress resulting in an average of almost 2 deaths among US Army Soldiers—hence, the rationale for developing such an app and making it available on a mobile computing platform. Availability on these devices ensures that critical heat stress guidance is readily available at lower echelons where laptop or desktop computing platforms and/or network connections back to a higher echelon (from which heat stress warnings would likely be disseminated) are not available. For a more detailed discussion of mobile device relevance to the military see, "Android Smartphone Relevance to Military Weather Applications".[4]

2. HEAT Inputs

To launch HEAT, simply tap the HEAT icon on the device (Fig. 1). The initial input screen is then displayed for the user to enter the site information (Fig. 2).

HEAT is a multiview (a view refers to an individual graphical user interface [GUI] screen) application with a tab bar (see lower portion of Fig. 2). The user enters the required inputs (default values always available) by tabbing through the various views and selecting the fields that he wishes to modify. Numeric inputs are checked for appropriate values and out-of-range values will not be accepted. Any invalid entry is replaced with the last valid entry. Upon HEAT exit, valid input values are saved (via data persistence) for display the next time the app is started. Text field inputs (latitude and longitude fields), labels ("Latitude", etc.), a segmented control (surface type), and date/time picker GUI elements are all used in the site view (represented by the farthest left icon on the tab bar). The date/time defaults to the current device time as initially set up by the user. If a global positioning system

(GPS) capability is present with the device, the latitude and longitude values could be automatically retrieved and displayed as the default values in the site view. Geographic location and date/time values are required to compute the solar irradiance value. Surface type is used to internally assign the fractional albedo value (see Table) required for the irradiance computation.

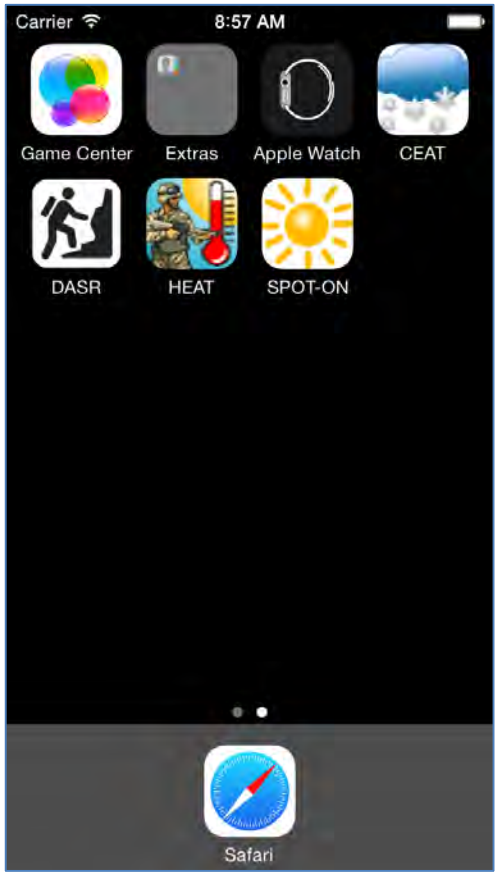

Fig. 1 Launch HEAT

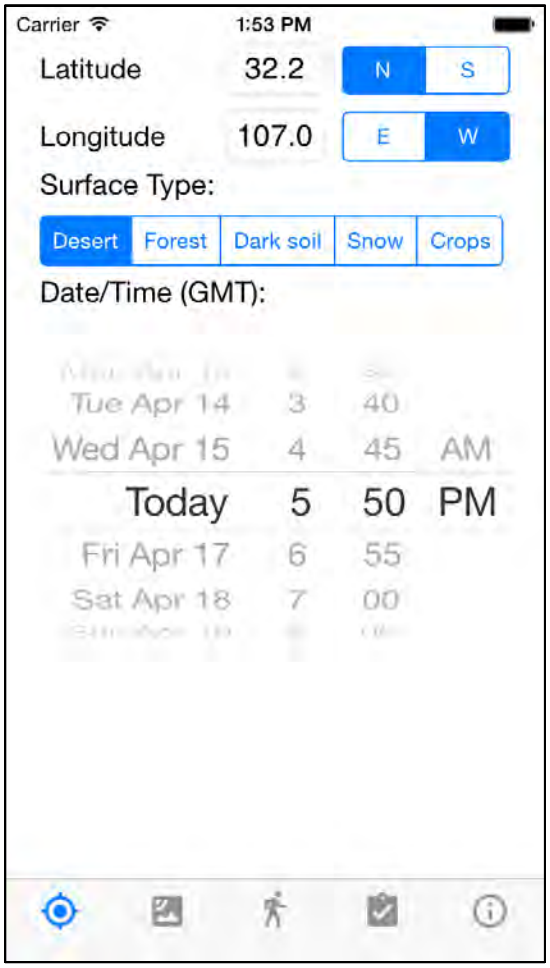

Fig. 2 Site view

Table Surface type and fractional albedo

Desert	0.30
Forest	0.15
Dark soil	0.10
Snow	0.55
Crops	0.20

The next view in the sequence of tabs (progressing from left to right) is the meteorological view (Fig. 3). This view allows the user to enter local weather conditions. As with the site view, this view consists of labels, text fields, and a picker (cloud type). A handheld weather sensor would typically be used in a tactical or training environment to assign the weather input values (wind speed, temperature, pressure, and relative humidity), while a visual observation would provide the cloud input information. Accurate meteorological inputs are essential for computing the WBGT value. This value, in turn, is used in conjunction with the Soldier work rate and clothing configuration to determine the output values.

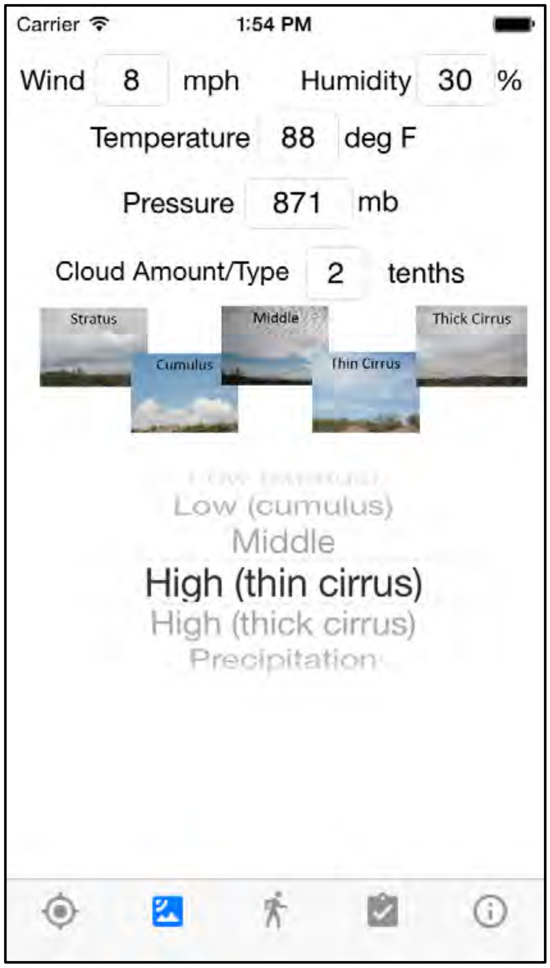

Fig. 3 Meteorological view

Once the meteorological values are entered, the user will typically proceed to the work/clothing view (Fig. 4), used to input the details about the Soldier's work rate and clothing configuration. Obviously the higher the work rate, the shorter the work/rest cycle and continuous work time will be, all other inputs being the same. Note that segmented control widgets are used for both of the inputs. Descriptions of the various work rates are available in the bottom half of the screen.

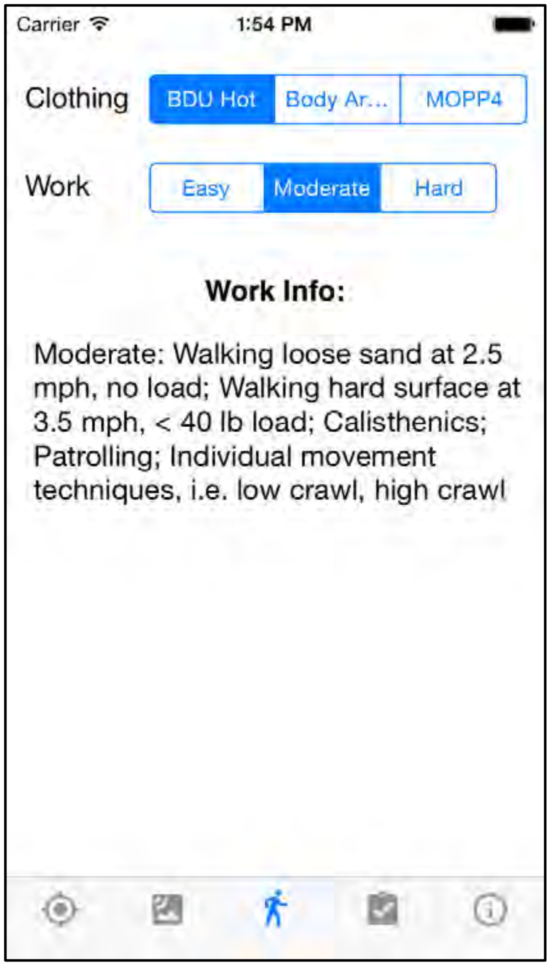

Fig. 4 Work/clothing view

3. HEAT Results

The results view (Fig. 5), provides the user with the work/rest times (60-min cycle), the continuous work time (after which Soldiers must be given an extended recovery time, preferably in the shade), the water intake requirements for each of the times, and the WBGT. Immediately upon tapping the results icon in the tab bar, the app computes the WBGT value per the guidance in the Liljegren document mentioned previously. The computed WBGT value is modified (if necessary) in accordance with the guidance provided in TBMED 507/AFPAM 48-152(I),[1] as a function of the clothing level, work rate, and humidity. For WBGT value modification purposes, "humid climates" as in the TBMED, are associated with a dewpoint temperature (computed internally but not displayed) of 20 °C or higher.

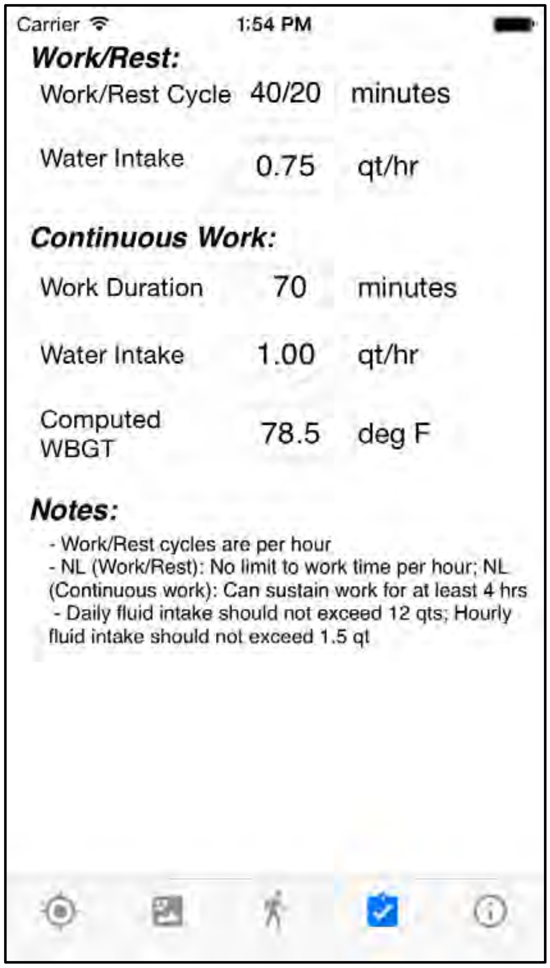

Fig. 5 HEAT results

The last view (Fig. 6), displayed by tapping the icon of an "i" in a circle, provides Point of Contact (POC) information, version, and date of the app.

Upon app exit, current values for all of the user inputs will be stored such that they will be the default values displayed when the app is next run.

Fig. 6 Information view

4. Summary and Conclusions

HEAT provides an easy to use and readily understood capability to determine work/rest cycles, continuous work times, and water intake values based on local weather conditions. Hosting on a mobile device makes it accessible virtually anywhere in a tactical or training environment.

5. References and Notes

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List of Symbols, Abbreviations, and Acronyms

app	application
GPS	Global Positioning System
GUI	graphical user interface
HEAT	Hot Environment Assessment Tool
POC	Point of Contact
TB	Technical Bulletin
WBGT	Wet Bulb Globe Temperature

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