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HISTORIC BURNHAM CEMETERY (BURNS 8BR85): DOCUMENTATION AND ANALYSIS OF A THREATENED ARCHAEOLOGICAL SITE AT CAPE CANAVERAL AIR FORCE STATION, FL

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HISTORIC BURNHAM CEMETERY (BURNS 8BR85): DOCUMENTATION AND
ANALYSIS OF A THREATENED ARCHAEOLOGICAL SITE AT CAPE CANAVERAL AIR
FORCE STATION, FL.

By

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Abstract

The Historic Burnham Cemetery was thoroughly analyzed using multiple methods including metal detector surveying, thermal imaging, and soil probing. This study aims to reanalyze previously collected ground-penetrating radar (GPR) data and profiles, done by William P. Boynton and published in 2015, to map the extent of the site and determine the locations of possible unmarked burials. This research is being completed as part of the Spring 2018 Cape Canaveral Archaeological Mitigation Project (CCAMP) at the Cape Canaveral Air Force Station (CCAFS). The main objective of this project was to document these coastal sites that are being threatened by rising sea levels. Boynton's field research consisted of on-site GPR surveys at nine sites on CCAFS, but this paper is only focused on his research of the Historic Burnham Cemetery. Boynton's ground-penetrating radar reflection images were then processed and refined through a standard software to make clearer and more defined depictions of the anomalies. For this project, a reprocessing and reinterpretation of those same images was required in attempt to match the Boynton's results.

Introduction

Ground-penetrating radar, used to study geophysical subsurface features, has been a major asset in archaeological research for quite some time. After popularity of large-scale ground-penetrating radar application spread through all different practices, the archaeological community quickly picked up on the potential of GPR to locate and define buried archaeological features, as well as sediment and soil layers (Conyers 2004). GPR data is collected through pulses of radar energy being reflected from a surface antenna, reflecting them off buried artifacts or features in the ground, and detecting those reflections back at the receiving antenna (Conyers 2009). The soil reflections collected through GPR testing show variations which allow the possibility of detecting potential excavation sites in a noninvasive manner (Boynton 2015). Ground-penetrating radar data is typically collected in closely-spaced transects within a set grid (Conyers 2004) allowing for higher quality coverage of the grounds of the cemetery. GPR can detect geophysical features, specifically in this case unrecorded burials, which do not have any artifact signature on the surface that could identify the spot (Boynton 2015).

The use of ground-penetrating radar to assist in the discovery of historic cemeteries can provide a great amount of information that might otherwise not be available from archived documents or other data sources (Conyers 2006), but the combination of historic cemetery findings and past records, such as birth certificates, can provide insight on the lives of the people who are buried. Historic cemeteries can be difficult because not all are maintained and taken care of to the same standard, and of course there is the effect of natural processes and human activity. Conyers (2006) describes ground-penetrating radar contributions to the acquisition of historic graves by giving burial depths, grave size, casket type and orientation, the number of graves, and the spatial distribution amongst the graves. As previously mentioned, these cemetery

characteristics can provide further insight on the socioeconomic aspect of the life of the person buried and the person (or people) who were part of the life during burial. It is important to use this useful technology to locate possible unmarked graves to ensure their preservation, just as the known graves, in threatened areas (Conyers 2006) such as the Cape Canaveral Air Force Station historic cemeteries. Boynton's main objectives, that will be discussed further in the paper, were to: (1) identify possible unknown burials at CCAFS, (2) test the effectiveness of ground-penetrating radar in a coastal environment, (3) compare the data from GPR survey with ethnographic information to increase the protection and maintenance with what is already available for the cemeteries.

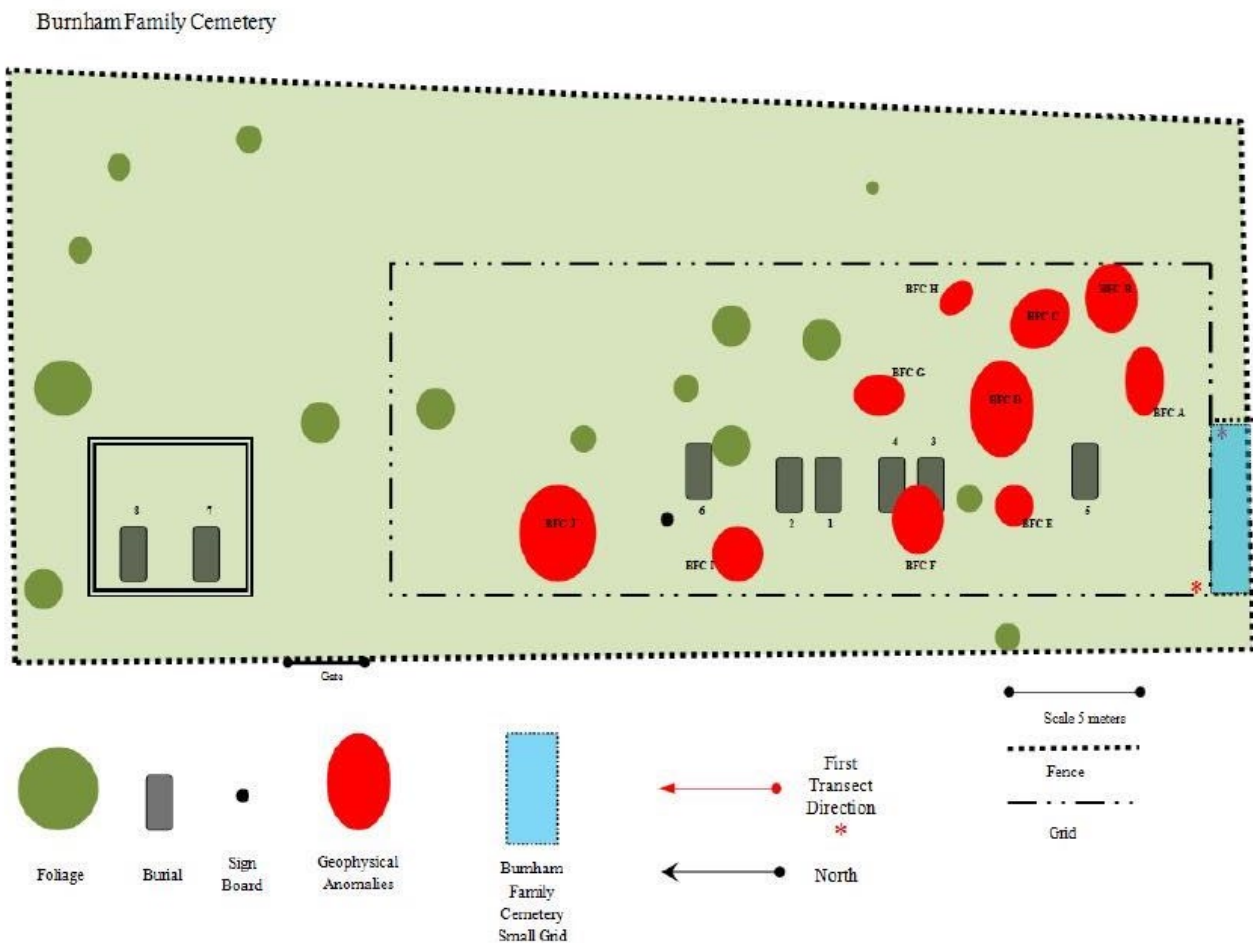
Background

Conyers (2004) discusses how past experimenting of inept methods to attempt to see subsurface features led archaeologists to use invasive methods (probing, random shovel tests, and trenching) as means of seeing below ground. Early experimental geophysical surveys that worked best included electrical and magnetic methods that were originally developed for mining, but these methods were still not conclusive because the anomalies that were presented were typically geological changes rather than archaeological features (Conyers 2004).

As previously stated, archaeologists adopted the use of ground-penetrating radar because of its potential to identify archaeological features. Advancements in technology allowed for data recording to be done digitally rather than by hand which led to faster acquisition and interpretation of data, faster mapping, and more ground coverage (Conyers 2004). GPR became popular within the archaeological community because archaeologists could ensure the preservation of the site during the practice of this surveying method, and it gave archaeologists a better point of knowledge for when it comes time to excavate, instead of blindly digging in an

area where there is not physical proof of an unmarked grave. Ground-penetrating radar for grave detection in cemeteries can be challenging because obstructions near the ground surface such as headstones and fences need to be put into consideration when it comes to complications in collection procedures (Conyers 2016). But there are also factors that can contribute to better and stronger GPR image readings. Water has one of the highest signal attenuation rates as dielectric constants (Conyers 2004). Per William Hawkins (2011), an increase in soil moisture appears to sharpen the grave signals in the reflection profiles.

The location of the known burials at the Cape Canaveral Air Force Station ensured their protection and maintenance, which allowed Boynton to focus on locating the possible unknown burials. The history of Cape Canaveral itself goes back to the pre-Columbian period, showing inhabitation through shell midden throughout the site along the Banana River (Boynton 2015).



Burnham Family Cemetery Anomaly Map, W. Boynton

Figure

The Historic Burnham Cemetery is named after the first lighthouse keeper of the homestead, Mills O. Burnham. The Cape Canaveral Air Force Station is home to seven known historic cemeteries: (1) Cape Road Cemetery, the only community/family cemetery, (2) Quarterman Homestead Cemetery North, (3) Quarterman Homestead Cemetery South, the focus of this paper (4) Burnham Homestead Cemetery, (5) Wilson Cemetery, (6) Penny Plot, that holds one named grave, and (7) a single grave holding Harry Osman (Boynton 2015). Our focus for this project, the Burnham cemetery is located between the Banana River and the south bound roadway of Samuel C. Phillips Parkway (Boynton 2015). The Burnham Cemetery, which is depicted in the figure above, contains eight burial plots belonging to Mills O. Burnham, his wife Mary A. Burnham, their daughter Frances Burnham Wilson, her husband Henry Wilson, their granddaughter Henrietta Wilson, her second husband Thomas Thompson, and Elliot J. Burns and an infant named Harold W. Butler (Boynton 2015).

Methodology

Site selection, equipment used, basic field methods, time of the survey, and general challenges are just few of the methodological approaches discussed by Boynton in his thesis. Ground-penetrating radar works best in areas of minimal biological and landscape modification (Boynton 2015) which was a major deciding factor in site selection and settling on the Cape Canaveral Air Force Station, as well as the level of maintenance of the cemetery in comparison to that of the other cemeteries on the base. Boynton's initial survey was conducted from August 2011 to October 2011, and in his thesis, he only mentions the re-surveying of two of the other onsite cemeteries. He redid these surveys to use the recommended 25 centimeters transects versus his original 50 centimeters.

The ground-penetrating radar has four components to it: a wheeled cart with a handle, a battery, antennas, and a control unit—which was a third-party laptop computer (Boynton 2015). All together, these components give the GPR the ability to collect data along transects, measure distance, and space reflection traces equally along transects (Conyers 2004). The GPR images are collected by sending pulses of radar energy that are reflected from the surface antenna, down

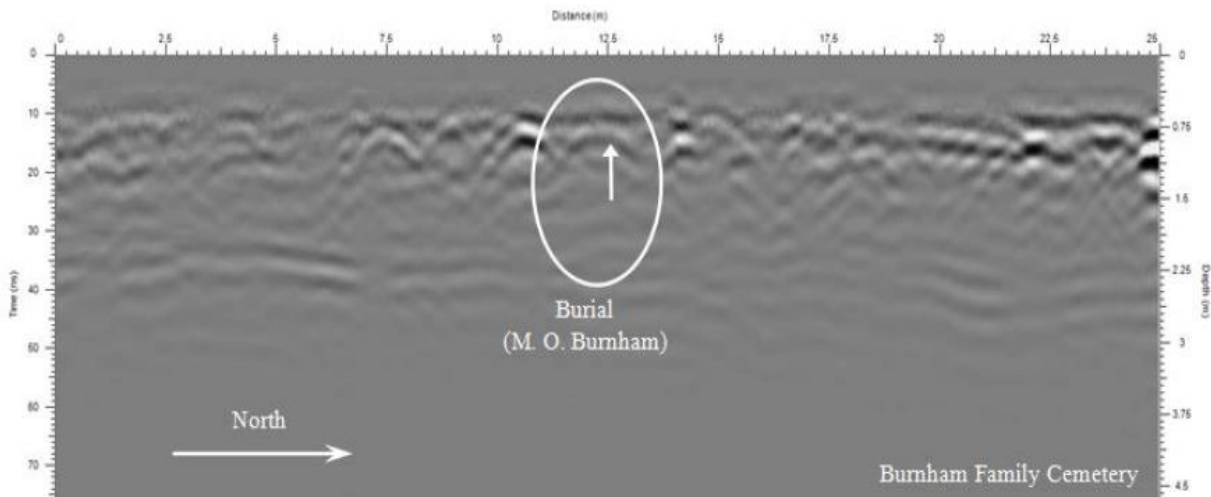


Figure 2 Burnham Family Cemetery, transect 11, source: GPRSoft® Pro Version 2.6.4

off the subsurface object or feature, and back up to the receiving antenna (Conyers 2009). The reflection images produced are changes in frequency waves as the radar pulses transmit through various materials on their way down (Conyers 2004). The above figure is an example of Boynton’s ground-penetrating radar reflection profile being put through post-processing and editing on the GPRSoft Pro software, showing the example of a known burial at the site, that of Mills O. Burnham. This software is essential to get as much out of your GPR data as possible. GPRSoft Pro provides important features and filters to more accurately read and interpret collected data from the transects. GPRSoft Pro offers a macro function for processing large data sets of GPR information. The macro function provides a template of one ground-penetrating radar slice profile to which ground surface, background noise reduction, filtering, and gain

enhancing were applied to the dataset to enhance the imagery; this was then applied to all the slice profiles of the data set (Boynton 2015). The three primary filters applied by Boynton to the reflection profile of each transect consisted of: setting ground zero of the profile, which adjusted time-zero to correct for the passage of the electromagnetic wave from the antenna through the bottom of the GPR unit and the ground surface; high and low pass filters which effectively reduce high and low frequency noises (e.g. human activity); and finally adjusting the gain which visually enhances the profile (Conyers 2013:129, 134-137). The first reflection recorded should be a reflection from the ground surface. The time window should not be exactly time zero but lagged a little below it so that the ground surface can always be found in reflection profiles (Conyers 2004). Also, the reduction of background noise enhanced the visual characteristics of the reflection profiles and allowed peripheral noise to be effectively processed out of the profiles (Boynton 2015). Adjusting the gain of the profile amplifies the lower amplitude waves received

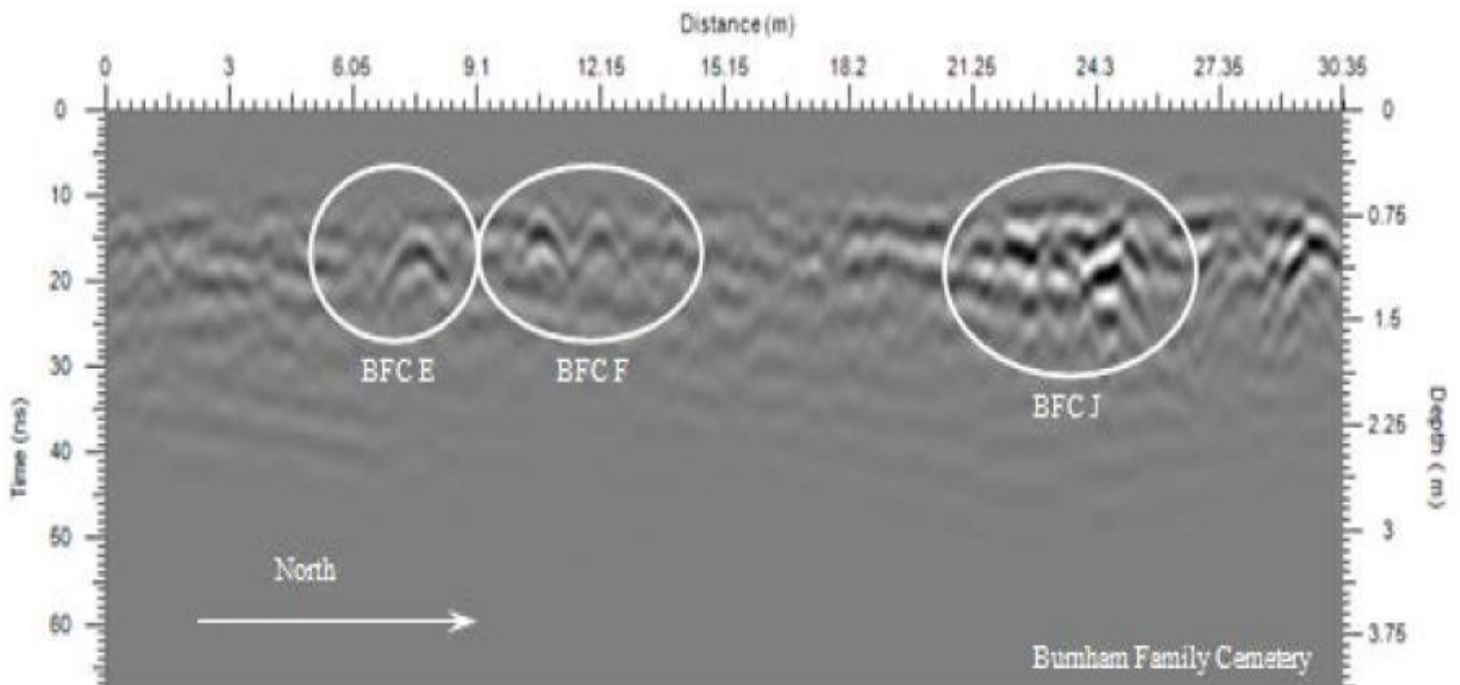
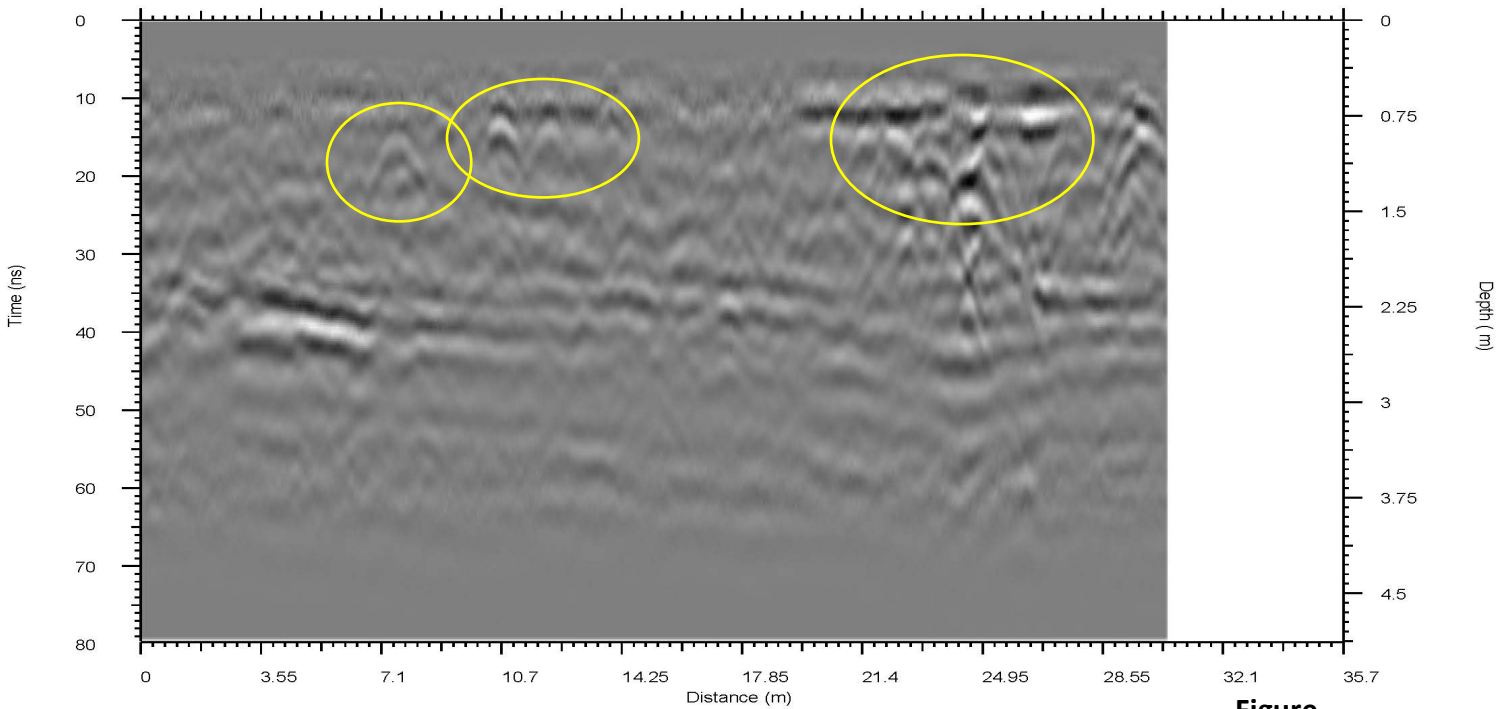


Figure Burnham Family Cemetery, Transect 13, source: GPRSoft® Pro Version 2.6.4

from deeper in the ground (Conyers 2004). In my attempt to duplicate his work, with the help of Dr. Sarah Stacy Barber, I utilized those same three filters and recreated a reflection image of Boynton's transect 13, as compared below.

File generated by GPRSoft®



Figure

Although they did not turn out identical, the detailed presence of the anomalies is still clear, and figure one gives reference to the spots on the cemetery in which the anomalies were mapped.

The GPR survey was conducted along a grid transect laid out perpendicular to the graves within the cemetery, which allowed for optimal documentation of geophysical anomalies of the sub-surface burial area (Boynton 2015).

Results

In preliminary ground-penetrating radar analysis at the Burnham Cemetery, there were anomalies present consistent with the known burials at the site, which led to the pursuit of further

investigation through other surveying methods, such as soil-probing, metal detecting, and thermal imaging. Those first GPR profiles were conducted on one group of burials and on two isolated burials because the cemetery offered an opportunity to discover unmarked graves, so a reference was needed for the positioning of the transects (Boynton 2015). Both Mills O. Burnham and the isolated infant's burials were not clearly or obviously indicated in the reflection profiles, but Burnham's daughter and son-in-law's appeared clearly (Figure 3, BFC F). Boynton's reflection profile point plot map (Figure 1) of the Burnham cemetery showed that this cemetery had the largest number of geophysical anomalies compared to the other cemeteries on site that he surveyed. Although, two of the three biggest areas with anomalies that dominated the area did have expected characteristics of a burial due to the intrusions from the surrounding trees (Boynton 2015); and it is possible this type of intrusion could be an explanation for the other similar anomalies. The most obvious indicators of a possible unknown burial are the east and west orientation and the spatial length of the anomaly (Boynton 2015). The conditions of the climate and the age of the cemetery could suggest very little remnants of burial artifacts, disregarding the burial shaft (Conyers 2006; Boynton 2015). The Burnham Cemetery being located on shell midden gave good prospects for the detection of a burial shaft (Boynton 2015).

Conclusion

The purpose of the research conducted was to test the use of ground- penetrating radar to survey in a coastal environment to locate unknown burials in the Historic Burnham Cemetery at the Cape Canaveral Air Force Station (Boynton 2015). The GPR proved to be a useful tool for sub-surface findings, but could not provide conclusive answers regarding whether there is or is not an unknown burial in the Historic Burnham Cemetery. The GPR survey confirmed the locations of burials that consisted of building materials such as brick and concrete coping,

granite and marble headstones and underground vaulting (Boynton 2015). Often times, older graves barely show up as amplitudes in profiles (Conyers 2006), and all things considering, the reflection profiles that were collected of the Burnham Cemetery provided a kick start to further investigation at the site. The spatial placement of graves and clustering of different age burials across a large area can often be used to show changes in burial types or in cultural practices in relation to methods of burying the dead (Conyers 2006). The amount of time since the burials were places and environments factors that could affect the Cape Canaveral site are major points in explaining the conflicting anomalies. Understanding how environment and time can impact experimental research on burials along coastal margins has proven to be valuable information. Boynton's research and analysis will provide guidelines and initial testing results for future researchers who intend on surveying the Burnham cemetery at Cape Canaveral, such as a team for University of South Florida (USF) who are going out this summer (2018) to do their own ground-penetrating radar surveys aiming to collect more substantial information on the cemetery and its possible, still, unknown cemeteries.

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