



Department of Defense Legacy Resource Management Program

Legacy Project # 09-443

Department of Defense Cultural Resources Data Management Needs Assessment

Versar, Inc.
6850 Versar Center
Springfield, Virginia 22151

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**Department of Defense
Cultural Resources Data Management
Needs Assessment**

Prepared for:

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Legacy Resource Management Program
Legacy Project #09-443

Prepared by:

Brian Crane and Dennis Knepper
Versar, Inc.
6850 Versar Center
Springfield, Virginia 22151

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1.0 INTRODUCTION

Versar, Inc. received funding in 2009 from the Department of Defense (DoD) Legacy Resource Management Program (#09-443) for the project entitled “Cultural Resources Data Management Needs Assessment.” This project involved a review and appraisal of the current state of cultural resources data management in the DoD and paths forward for future data integration. This project prepared an assessment of current DoD cultural resources data and data management practices with recommendations for incorporating existing DoD cultural resources data into newly developed data standards developed for the Spatial Data Standard for Facilities, Infrastructure, and Environment (SDSFIE), and for DoD cultural resources spatial and associated business data. The project developed a questionnaire and protocol for assessing the current state of cultural resources data design and storage on DoD installations nationwide. The data assessment protocol was then implemented on a sample of installations from the Air Force, Army, Navy, and Marine Corps. The results of the data collection were analyzed and are summarized in this report. This report includes recommendations for refining the assessment process and estimates for the level of effort likely to be needed to collect and migrate existing cultural resources data to the new standards.

2.0 BACKGROUND

2.1 Problem Definition

Throughout the past decade, the DoD has been striving to achieve business transformation by implementing changes to technology, process, and governance. Part of this effort for each functional program is the definition of explicit business process standards that cross all component organizations.

During 2007 and 2008, DoD began to develop minimum data standards for DoD cultural resources spatial and related business data as well as substantially reworking the SDSFIE (Beckel 2009: Legacy Project 08-409). Previously, USAF Air Combat Command (ACC) developed, with Legacy support (Project 981755) the developing the Military Cultural Resources Analysis Database (MCRAD) as a candidate system for the cultural resources sub module of the USAF Automated Civil Engineer System – Environmental Management (ACES-EM), in coordination with other Air Force major commands and the Tri-Service CADD-GIS Center at Vicksburg (Crane 2000). As part of that effort, cultural resources data from 48 DoD installations were entered into MCRAD to test the viability of the data model and identify areas of needed refinement. There have also been other Legacy projects that have focused on collecting cultural resources related documents (*Legacy Cultural Resources Bibliography and Document Library* Project 08-404, *Index and Database of Cultural Resources Agreement Documents* Project 08-405, and *Guidance for CRM Information Clearinghouse* Project 07-351).

These data entry exercises have provided valuable insights into the nature and extent of cultural resources electronic data in DoD. However, there is no comprehensive inventory of electronic cultural resources data in DoD that would allow for an accurate estimate of

the level of effort that would be needed to update these data with the new SDSFIE and draft DoD Cultural Resources Business Data Standards.

2.2 Previous Surveys

Versar reviewed the results of other DoD electronic cultural resources data management and inventory projects. These included a 2006 Army Environmental Center (AEC) survey of cultural resources data and surveys conducted in 2009 by the Navy and Marine Corps. The 2006 AEC survey of cultural data at over 150 Army installations addressed the proportion of cultural resources data at installations that are available in electronic format, and the file formats used. However, the AEC survey did not collect data about the number of records, specific data elements collected or measure compliance with the current SDSFIE. The survey covered a range of cultural resources records topics, beyond those dealing strictly with electronic data. Questions asked in the 2006 AEC survey included:

1. For what percentage of recorded archeological sites counted in The Army Environmental Database - Environmental Quality (AEDB-EQ) do you have site forms on file?
2. If you do not have all of your site forms, please explain if they are lost, or elsewhere and what would be needed to be done to retrieve them or recreate them.
3. Please identify any software your installation uses for management of archeological sites and information. Please include all systems that your installation uses with archeological site data and if the system(s) is integrated or linked with any other system (For example: MS ACCESS database, ESRI, etc.).
4. What percentage of your installation's recorded archeological sites is recorded in a GIS system?
5. How many properties still have "H" codes in your installation's Integrated Facilities System (IFS)?
6. Have you recently updated IFS to input all relevant historic properties data on the Historic Properties screens and confirmed all current historic codes? Please work with your IFS Real Property person to ensure all codes utilized in IFS are actual and up to date. Source documentation is required to verify and support all codes used in IFS.
7. Please identify if all source documentation is available on all recorded archeological sites and where these are kept. (For example, all inventory reports, site forms and concurrence letters from the State Historic Preservation Officer (SHPO) and Keeper are on file with the installation CRM.)
8. What percentage of your source documentation on archeological sites, such as site forms and confirmation letters from SHPO, is available electronically?
9. Please identify if all source documentation is available on all eligible or listed historic buildings and structures. (For example, nomination forms and concurrence letters, reports, etc.)
10. Please identify what you use as source documentation to confirm eligibility or listing of historic buildings or structures. (Integrated Cultural Resources Management Plan [ICRMP] is NOT a source document). Please include the location of the

documentation signed by the SHPO concurring on your Determination of Eligibility (DOE) or the location of the documents sent to the Keeper confirming your National Register listing or National Historic Landmark status of installation buildings and structures.

11. What percentage of your source documentation on buildings and structures, such as reports and confirmation letters from SHPO, is available electronically?
12. If any of the source documentation is in electronic format, what types of electronic format is it in? (For example: Adobe .pdf, MS Word, etc.)
13. Does your installation have any Properties of Traditional Religious and Cultural Importance, or Sacred Sites?
14. Please identify any software your installation uses to track information on properties of traditional religious and cultural importance and/or Sacred Sites.
15. Please identify what types of source documentation you use to confirm National Register eligibility or listing of properties of traditional religious and cultural importance and/or Sacred Sites.
16. Please include the location of the documentation signed by the SHPO concurring on your DOE or the location of the documents sent to the Keeper confirming your National Register listing or National Historic Landmark status of installation properties of traditional religious and cultural importance or Sacred Sites.
17. What percentage of source documentation is available electronically?
18. What electronic format is the documentation in? (For example: Adobe .pdf, MS Word, etc.)
19. Does your installation have a federal collection of archeological artifacts associated with your installation under 36 Code of Federal Regulations (CFR) 79?
20. Where is your federal collection located?
21. What percentage of your federal collection is maintained at an offsite location?
22. Please identify if your collection is in more than one offsite location.
23. Who manages your off-site federal archeological collection?
24. Is your collection housed at a site that meets 36 CFR 79, if applicable?
25. Do you maintain an up-to-date itemized inventory of all federal collections associated with your installation?
26. What inventory/management software is used to organize the collection?
27. Does your installation manage records related to a state collection?
28. Please provide point-of-contact (POC) details of the person responsible at the offsite location(s).
29. Are there any other organizations, SHPOs, tribes or others who currently have access to your data systems?
30. Are there any other organizations, SHPOs, tribes or others who you would like to provide access to your data systems?
31. Please identify any data or information systems that you believe would be helpful to cultural resource management at your installation or within the Army.
32. Please identify if you have any sensitive data other than archeological sites and Sacred Sites that should not be released to the public.

In the Army survey, respondents reported approximately 79 percent of recorded sites had site forms available in electronic form; however, only about 40 percent of the

accompanying source documentation was available in electronic format. For architectural resources, approximately 44 percent of applicable documentation was available in electronic format.

Of those Army installation respondents that maintained archaeological data in electronic format, half did so using ESRI GIS software. The remaining respondents employed a mixture of MS Access, MS Excel, other GIS software, Word, Adobe, and other database applications. Most installations that reported using an application to store their data reported using more than one. Table 1 gives the frequency that different applications were cited in the responses.

Software	Total
ESRI GIS	63
Access	27
Excel	27
Unspecified GIS	14
Word	8
Adobe	3
SQL Server	2
Trimble	2
AutoDesk	1
AZ Site	1
Other database	1
IFS	1
Microsoft Front Page	1
Microsoft SQL	1
MS Office	1
Oracle	1
Pride database	1
RE: Discovery	1
TG Office	1
Word Perfect	1

Only 27 of the 138 responding installations had data collected for traditional cultural properties (TCPs) and sacred sites, and all but 5 of these had those data in digital form. The applications used included the same broad range of applications in Table 1. A larger number of installations have digital data for archaeological collections. A total of 83 out of 138 responding installations indicated that they had archaeological collections. Table 2 gives the incidence of specific software applications used to maintain inventories of archaeological collections. As is the case for other types of cultural resources data, the use of applications is highly variable.

Table 2: Software used for Artifact Collections Data	
Artifact Software	Total
MS Access	19
Excel	11
Filemaker Pro	3
USAMS	3
Word	3
Re:Discovery	2
Multiple	13
None	28
Unspecified	5
Unknown	4

The Navy also conducted a survey of cultural resources data at 103 of its installations in 2009. The survey covered National Register eligible archeological sites, archaeological survey areas, Native American sites, Historic buildings/structures, and National Register Historic Districts. Any database developed within the Navy must be compatible with the Maintenance and Analysis (M&A) environment that supports the Naval Facilities Engineering Command's (NAVFAC) Regional Shore Information Management System (RSIMS). A database is stored (published) in the M&A environment; RSIMS can then pull spatial data onto maps and publish (create electronic) maps displaying various layers. For each installation the need for data in the given category was stated, and the percentage of the required data that were either published in M&A or in RSIMS. The results showed that in most cases where data were required, it had been published in M&A or RSIMS. However, relatively few of the 103 installations are shown to have cultural resources data requirements (9 reported having archaeological site requirements for example). Table 3 shows the count of installations with cultural resources data requirements by type of data. The percentages shown reflect the percentage of data reported that have been published in M&A and RSIMS. The first column shows the count of installations reporting cultural resources by category of resource. The results show a surprisingly low number of installations with cultural data requirements, but a high percentage of those installations have data published in M&A.

Table 3: NAVFAC Cultural Resources Data			
	Count of Installations	%M&A	%RSIMS
Archaeology	9	100%	11%
Surveys	13	96%	8%
Buildings	19	84%	12%
Districts	12	88%	21%

A survey conducted of Marine Corps bases in 2009 yielded similar results. A query was sent out to 18 installations, with responses received from 13. The survey asked installations about:

- Data Types tracked
- Applications Used
- Data Not Managed electronically
- Amt of Data
- Maintaining Organization
- Data Status
- Funding
- Storage
- GIS data
- Volume/Number of Documents
- Hard copy storage of Documents
- % Hard copy only
- Electronic storage requirements for Documents; and
- Where documents are stored

Table 4 lists the number of responding installations that maintained data about identified categories of cultural resources.

Table 4: Cultural Resources Data Collected at Marine Corps Installations	
Data Types	Total
Archaeological collections data	10
Archaeological Site Data	10
Archaeological survey/eval data	10
Burials/cemeteries	10
Historic building/structure data	9
Consultation data	7
Native American/Native Hawaiian resources	7
Mitigation tracking data	5
Total	67

Table 5: Applications for Marine Corps Cultural Resources Data Management	
Applications Used	Total
ArcGIS	7
Excel	6
Access	4
None	2
Adobe Acrobat	1
GIS	1
KE EMU collections database	1
MS Word	1
Other	1
Total	24

The status of these data ranged from ‘being implemented’, ‘implemented but requiring update’, to ‘actively maintained’. Data (especially GIS data) appeared to be generally stored on the GeoFidelis Server, though there may be some other data stored on individual PCs.

None of the preceding surveys collected information about the attributes used to describe cultural resources data. However, example data collected during other Legacy projects were examined from 41 Air Force installations, as well as Fort Eustis, Fort Drum, NWS Yorktown, MCBs Quantico and Pendleton, and the Marine Corps Air-Ground Combat Center Twentynine Palms. Most of the data from these installations was initially provided either in MS Excel format, or in ESRI shape files (Green 2001). The attributes were frequently limited to Property Name, Site Number, and National Register eligibility. Where additional attributes were provided, it appeared that were chosen on a project specific basis, and not necessarily according to the SDSFIE or other standard. This experience together with the data surveys among the Army, Navy and Marine Corps suggest that a significant amount of cultural data has been collected in digital form, but that there is a broad diversity of practice for how those data are collected, described and managed.

3.0 SURVEY DESIGN AND IMPLEMENTATION

3.1 Design

The topic of conducting the data inventory was broached at the April 6, 2009 kickoff meeting. Attendees representing 14 organizations (Table 6) were questioned about previous data inventories conducted by AEC and National Guard Bureau (NGB), but no one on the call was familiar with either. Attendees did note that there were recent or current data inventories in the Air Force, Navy, and Marine Corps. The group recommended that any new survey coordinate with these other efforts to avoid duplication, and that questions first be coordinated through the working group leads, rather than sent out to installations. Concern was expressed about too frequent data calls for installations. Initial topics for the survey were discussed, including nature of the data, frequency of maintenance, responsibility for maintenance, how stored, and how funded.

The topic of the survey was taken up again at the June 4, 2009 teleconference. The consensus of the group was that a modified version of the Marine Corps survey form could be made available for completion on the internet, and cultural resources personnel at installations and commands could be invited to fill it out as they had the opportunity. It was felt that such an approach would be better received by the field than a formal data call.

Subsequent to the June conference call, Versar developed a draft survey design and distributed it for comment from selected members of the Working Group. Versar amended the survey design based on the comments, and posted the final survey design at

<http://www.versar.com/cr-questionnaire/> on September 3, 2009. The survey web page is shown in Figures 1 and 2.

Table 6: Organizations Represented in the Working Group

- Defense Installation Spatial Data Infrastructure (DISDI)
- Eglin AFB
- Fort Leavenworth
- Headquarters Air Combat Command
- Headquarters U.S. Marine Corps
- Legacy Resource Management Program
- Mandatory Center of Expertise for the Curation and Management of Archaeological Collections (MCX-CMAC).
- MCB Quantico
- Naval Facilities Engineering Command
- U.S. Air Force Academy
- U.S. Army Corps of Engineers ST. Louis District
- U.S. Army Corps of Engineers Walla Walla District
- U.S. Army Reserve
- Versar, Inc.

Questionnaire: Cultural Resources Data Management and Storage
 Installation Respondent

Part I Cultural Resources Data:

1. What types of cultural resources data do you manage? (check all that apply)

Data Type	Primary Application	Secondary Application
<input type="checkbox"/> Archaeological site data	<input type="text"/>	<input type="text"/>
<input type="checkbox"/> Archaeological survey/evaluation data	<input type="text"/>	<input type="text"/>
<input type="checkbox"/> Archaeological collections data	<input type="text"/>	<input type="text"/>
<input type="checkbox"/> Consultation data	<input type="text"/>	<input type="text"/>
<input type="checkbox"/> Historic building/structure data	<input type="text"/>	<input type="text"/>
<input type="checkbox"/> NAGPRA Items	<input type="text"/>	<input type="text"/>
<input type="checkbox"/> Burials/cemeteries	<input type="text"/>	<input type="text"/>
<input type="checkbox"/> Mitigation tracking data	<input type="text"/>	<input type="text"/>
<input type="checkbox"/> Sacred Sites	<input type="text"/>	<input type="text"/>

List Others

2. Are there any types of data that you need to manage that you do not currently manage through a database, GIS, or spreadsheet?

3. How much data do you manage? (e.g., < 100 Resources, 100-500 resources, etc.)

Number of Resources/Records

Amount of Electronic Storage Space Used

4. What position or organization maintains/updates the data files cited in Item 1 above?

5. Are data actively maintained (i.e., are data updated as needed)? If yes, how is data maintenance funded?

6. Where are the electronic data stored (e.g. on a LAN, Desktop, CD, or other)?

7. Which CR data listed above are included in installation GIS? How is it included (i.e. as part of what layer)?

Part II Cultural Resources Documents:

1. Approximately how many documents other than site forms have been prepared for your

Figure 1: Online Survey Form (page 1)

installation (include ICRMPs, survey and evaluation reports, historic contexts, data recovery reports, recordation reports, agreement documents, etc.)? How many total linear feet of shelf space do they occupy?

Number of Documents	Linear Feet	Electronic Storage Space Used
<input type="text"/>	<input type="text"/>	<input type="text"/>

2. Does the Cultural Resources Manager have copies of all of these documents? If not, who else manages/stores these documents?

3. About what percentage of these documents is available in hard copy only?

%

If at all possible, please submit blank database or spreadsheet file structures that show what attributes are being recorded for different resources.

Figure 2: Online Survey Form (Page 2).

3.2 Survey Results

The respondents included 19 individual installations, six larger entities (e.g., St Louis District, USACE; or HQ AMC), and two that were not clearly identified. Tabulated responses are included in Appendix A.

installations (n=19):

- Andersen AFB
- Arnold AFB
- Barksdale AFB
- Elmendorf AFB
- Holloman AFB
- Minot AFB
- Mountain Home AFB
- NAS Meridian
- NASP
- NAS Whiting Field
- NAVFACMW CRANE
- NCBC Gulfport
- Nellis AFB
- Picatinny Arsenal
- Shaw AFB
- Tinker AFB
- U.S. Air Force Academy
- Whiteman AFB
- Hill AFB

large entities (n=6):

- CEMVS-EC-Z
- St. Louis District, USACE

- HQ AMC
- PACAF
- USAF
- U. S. Navy, NAVFAC, MIDLANT

also (n=2):

- UNSPECIFIED
- blank

In the analysis, installations were, in some instances, considered separate from the larger, overarching entities on the assumption that needs and resources might be different at the two levels.

The design of the survey form influenced the results in certain ways. Drop down menus for the application types helped make responses consistent; however, it was possible to indicate that a category of data was collected (e.g. archaeological sites) without specifying any application used. It was possible to leave the responding installation blank (2 did this). The other questions allowed for free data entry, which allowed a lot of flexibility, with the loss of some consistency.

Types of CR data and application software

The first set of questions concerned the frequency of application software types used to store the Data Type categories (Table 7).

Data Type	Percent of Responding Installations Collect	Percent Use Multiple Data Types
Archaeological Sites	74	56
Archaeological Survey Data	74	48
Archaeological Collections	56	26
Consultation	67	22
Buildings	74	52
NAGPRA Items	15	4
Sacred Sites	15	11
Burials	37	22
Mitigation Measures	41	19

Responses to the type of software used to store cultural resources data indicate a broad range of practice. Table 8 shows the overall percentage of applications used, while Table 9 shows the percentage of software applications used as the primary application by cultural data type. "Other" includes WORD and PDF files, hard copies, and some specific software (e.g., GeoMedia and Geomedia Pro).

Table 8: Frequency of Specific Application Software Used to Store Data Type Categories

Data collected	ArcGIS	11%
(n=180)	Excel	27%
	Access	19%
	Oracle	3%

Other	40%
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Table 9: Applications Used by Data Type

	ArcGIS	Access	Excel	Oracle	Other	Unspecified	Uncollected
Archaeological Sites	40%	5%	25%	0%	25%	5%	26%
Archaeological Survey Data	45%	5%	10%	0%	25%	15%	26%
Archaeological Collections	0%	13%	53%	0%	20%	13%	44%
Consultation	0%	17%	11%	0%	61%	11%	33%
Buildings	25%	5%	30%	0%	35%	5%	26%
NAGPRA Items	0%	25%	25%	0%	50%	0%	85%
Sacred Sites	50%	10%	0%	0%	40%	0%	63%
Burials	18%	18%	18%	0%	45%	0%	59%
Mitigation Measures	50%	0%	0%	0%	50%	0%	85%

Of the four specific applications (n=108), 68 percent are stored in database management software (ArcGIS, Access, Oracle), the rest in spreadsheets. Of the records in database software, about two-thirds are in ArcGIS. Notably, of the data not in GIS, more records are stored in spreadsheets (Excel) than in databases (Access or Oracle).

So, a small majority of the data in the reported sample (56%) is already in some sort of tabular form, and much of that is in database format (GIS, Access, Oracle). When the remaining data are digitized, they can be formatted for a smooth transition to the appropriate data structure (whether SDSFIE, the new SDSFIE, MCRAD, etc.). Time will not need to be spent moving data from a pre-existing structure while re-formatting it so that it can be imported correctly. The data can be formatted properly as they are digitized. Procedures and formats should be established up front though, to make the digitizing as efficient as possible. To fit into the database, the information will need to be tabularized as well as digitized and, obviously, it is the formulation and structure of the tables that will determine the efficiency of the importation process.

Other Data Storage Needs

Approximately one-third of the respondents indicated that they have data needs that are currently not met digitally (i.e., not managed in a database, GIS, or spreadsheet, Table 10). While several indicated that they still have considerable data in paper documents, another frequent item mentioned is photographs/video (responses to question 2).

Table 10: Sample Responses to Question 2 (other data needs):

- All the surveys, ICRMPs are paper with more recent ones in Word or PDF
- Training status of base CRMs
- 90% or better of our paper records. Better attribution and site extents.
- A 30,000 original storage photo and video library of 50G on separate backup drives
- Archaeological site data
- Memorandums of Agreement; Building pictures
- Historic Photos, Newspapers, Articles, Interviews

- Archeological sites/surveys and historic structure data needs to be updated for current management
- 2000 ICRMP

As above, this situation can be viewed optimistically as a clean slate, allowing the ability to design an appropriate format for the incoming data rather than trying to adapt several formats into a compromise. Bringing imagery in will require some thought though, precisely because of the existing formats. So it’s not really a clean slate. There are diverse existing formats in which imagery is stored at these locations—.jpg, .pdf, .tif, various Illustrator formats, .img (GIS), just to mention a few of the still image formats. Video formats are a separate issue with which we will need to become familiar. The point is, rather than attempting to force all of the existing imagery to be scanned and submitted in a single format like .jpg, the process should be as inclusive as possible without sacrificing efficiency.

Storage Size – Resources/Records

Storage space requirements vary with the two types of respondent, since the larger entities tend to have more physical area under their jurisdiction. The mean number of resources reported overall was 1,176 with a median of 237. Yet, even with all the data included, the sample size was small (18 respondents provided data on number of resources) and the mean was heavily skewed by three outliers: U. S. Navy, NAVFAC, MIDLANT reporting 10,000 resources; Mountain Home AFB reporting more than 6,000; and St Louis District, USACE reporting more than 1,000. The mean for installations only (13 respondents) was 697 (again skewed by Mountain Home AFB), with a median of 200 (Table 11).

Table 11: Storage Size	Number of Records
mean (total)	1176
median (total)	237
mean (installations only)	697
median (installations only)	200

The actual digital storage space was only reported by a few respondents and varied greatly. It ranged from less than 10 MB to more than 100 GB, suggesting that hardware variations may need to be taken into account when determining the size and form of the database that is distributed.

In the end though, storage space would seem to be a minor concern, especially with the capacity of present-day computers. One place where the number of records/resources might be an issue would be in conversion, if for example there are is a great deal of analog data present or large databases with data structures that are not immediately compatible with the standardized fields. Those kinds of data can take awhile to sort through and manipulate.

Note, there may have been some confusion about what to report in this query. At least one response to Number of Resources/Records indicated “5,000 records and reports.”

Storage Size – Number of Documents

There was less range in the number of documents reported. The sample size was again small (16 respondents provided data on the number of documents). One outlier was evident – the Unidentified respondent (blank), who reported more than 1,000 documents. The mean number of documents reported by installations was 95, with a range of 7 to 389 (Table 12).

Table 12: Documents	Number of Documents
mean (total)	148
median (total)	100
<hr/>	
mean (installations only)	96
median (installations only)	56

Storage space was again irregularly reported in the survey results, ranging from 32 MB to 20 GB.

Physical space reported ranges from 1 to 40 linear feet, with information from 15 respondents total, or 12 installations. There is little difference between the means (Table 13).

Table 13: Physical Storage Space	Linear Feet
mean (total)	15
median (total)	14
<hr/>	
mean (installations only)	15
median (installations only)	8

Who maintains/updates the data files? (Resp. 4)

Most of the data at installations is handled by a Cultural Resources Manager, or someone within civil engineering, public works, etc. Others listed included a forester, geographer, asset manager, real property manager and conservation data manager. At the larger entity level, two CRMs and a data analyst were noted. The relatively high number of responding CRMs may simply indicate that installations with CRMs in place are more likely to respond to the questionnaire and to provide useful detail.

Active Maintenance/Funding (Resp. 5)

About 75 percent of all respondents (20 of 27) indicated that their data are actively maintained. At the installation level, five respondents indicated that they do not actively

maintain their data. Of the remaining 14 installations, 10 reported funding from general sources, and four did not specify or said the funding source was unknown. Policy regarding funding for the collection, storage, and maintenance of digital data should be more clearly articulated.

At the larger entity level, all eight respondents reported active maintenance of data: two funded by projects; two by general funds; one by both; and three were unspecified.

Again, the high frequency of responses indicating active maintenance may be as much a factor of who responded to the questionnaire as an accurate representation of the degree of maintenance. That is, installations that do not keep their cultural resources data current may be less likely to participate in the survey.

Where are the electronic data stored? (Resp. 6)

At the installation level, just over 50 percent of the respondents reported keeping data on a network (a few reported a network and PC). About 30 percent reported use of PCs alone. Three installations did not respond to this query.

At the larger entity level, most (6 of 8) reported keeping data on a network. Although none reported using a desktop alone, half reported storing data on both a network and a desktop. Two entities did not respond to the query.

The results of this query may correlate with the size of the installation/entity, with larger facilities more likely to have a network at their disposal. An informal estimate of facility size suggested that size was indeed a factor, with all but one of the large installations and entities reporting networks, while the smaller installations were as likely to have data on a desktop as on a network.

3.3 Survey Critique

In the end, it is hard to do much statistically with such small samples, since only one or two outliers can skew any central tendency numbers. In addition, a number of the survey questions allow for free form answers rather than quantitative answers or selections from categories, making the results harder to tabulate or summarize. There may also have been different understandings among respondents about the use of the term “resource” in the questionnaire.

In order to obtain more standardized answers that can be used to generate larger, analytically useful samples, more specific questions may need to be composed, or perhaps more pick-lists could be used (with fewer categories like “Other”). In Part 2, Query 2, for example, instead of asking who manages CR documents if not the CRM, it may be better to provide a list of possibilities: e.g., natural resources manager; asset manager; GIS manager; community planner (the entries in the pick-list would depend on what is important about knowing where the documents are kept – a breakdown like the one suggested may not be critical knowledge). In another example, Query 7 seemed to

have been open for interpretation among the respondents. The answers suggest that respondents did not read the question the same way, so a variety of answers resulted, which made analysis of the results difficult. The question was at once too open-ended (too many possibilities for how or what to answer) and only applied to facilities where a GIS is in use. A glossary of terms, or other explanatory material may also be helpful.

4.0 CONCLUSIONS

Proper data storage and management are critical to the continued success of the DoD cultural resources management program. Collecting data in idiosyncratic formats makes those data very difficult to compare with other data sets. Every year, higher echelons attempt to collect current data on the number of historic properties in the DoD inventory, and the extent of efforts to identify and evaluate those properties. But due to the lack of consistent data or enterprise cultural resources data systems, these efforts seemingly need to start from scratch each year.

A more serious problem relates to data preservation. Curation of electronic archaeological data falls under the provisions of Section 112(a)(2) of the National Historic Preservation Act (16 USC 470h-4(a)) and 36 CFR Part 79. Data that are not actively maintained may be at significant risk of loss.

In addition to the goal of improving the accessibility and overall utility of archaeological data, the field faces extraordinary problems of data loss. Archaeological data obtained at great expense are being lost, often irretrievably, at an alarming rate. In some of our recent synthetic efforts, we have not been able to locate primary data, even for recent projects with the full cooperation of the investigator. Digital data are being lost through degradation of electronic media, and software obsolescence.

Kintigh 2006.

Unless steps are taken to systematically collect and store electronic data, those data will likely ultimately be lost or become unusable in time. In collecting artifact catalog data for Legacy Project 06-318, complete paper copies of reports and inventories were located, but in some cases the original electronic data had been lost (Crane 2007). Clear policies for the curation of digital data along with artifacts and field records from archaeological projects should be developed and included with project scopes of work.

A significant amount of DoD cultural resources data has been digitized, but those data appear to be heterogeneous in format. The survey results show that a wide range of applications are used, though most historic property data exists in tabular format (spreadsheet or database). Supporting data (archaeological collections, or data about reports and surveys) are less likely to be digitized or available in tabular form. While few respondents to the survey provided details about the specific attributes used, what data were provided, along with information available from previous Versar data migration

tasks, suggests that few installation cultural resource managers or contractors have used the cultural resources data structure and attributes provided by the SDSFIE, and most cultural resources data are described using attributes developed by the installation, or selected on a project-by-project basis. Release and active implementation of Version 3.0 of the SDSFIE should help with this problem.

Considerable effort may be needed to map existing fields to those recommended in the draft cultural resources business data standard. Alternatively, existing data can be left in legacy formats, while new data are collected in more standardized datasets. Because the data are in various formats, this may mean that in some instances, existing legacy data sets may be impractical to reconcile efficiently with the draft DoD standard. An alternative to migrating all of the data would be to incorporate existing data in its present tabular form into a geodatabase, mapping the tables to shapefiles in the SDSFIE and only re-formatting key data. Remaining data would be left in its original form. Figure 3 shows a schematic example of a set of Legacy GIS data about cemeteries or burial sites linked via a foreign key (i.e. a field in a relational database record that points to a key field in another table) to the SDSFIE table CemeteryOrBurialSite. The latter is then connected to a cultural resources data standard compliant business dataset. The data would not be fully searchable, but would at least be included in the overall data structure and thereby would be available. In cases where there was only tabular data and no spatial data, the legacy data set could be linked via a foreign key to data standard compliant business database, as shown in the example in Figure 4. This method of linking the data would also work in cases where spatial data were present, but do not map easily onto the spatial feature classes defined by the SDSFIE.

This approach would follow current trends advocated by some within the emerging field of archaeoinformatics by allowing for more loosely structured data, accompanied by clear metadata (Kintigh 2006, Snow 2006). Archaeoinformatics is defined as “the application of integrated information technologies in a comprehensive, multi-scalar approach to field data acquisition, processing, analysis, dissemination and archiving of information about the human and pre-human past” (Center for Advanced Spatial Technologies 2007). A cyberinfrastructure would:

Integrate data collected at different scales, at different times, by different investigators using variable data recovery strategies and inconsistent typologies; adequately encode complex typologies, data recording schemes, archaeological contexts, and recovery techniques; and, most importantly that it is neither necessary nor advisable to reduce data to a single standard at registration time. Instead, the semantics of new and legacy data must be preserved.

Kintigh 2006:5.

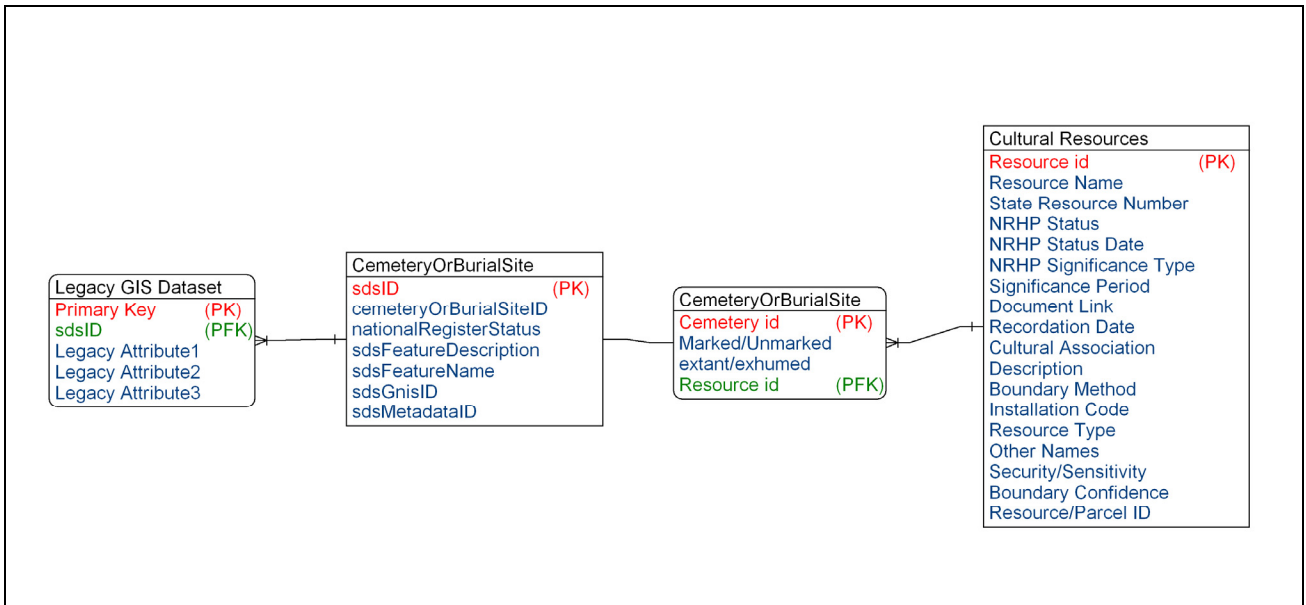


Figure 3: Example existing legacy dataset linked to a DoD draft standard compliant cultural resources business database via an SDSFIE compliant spatial table.

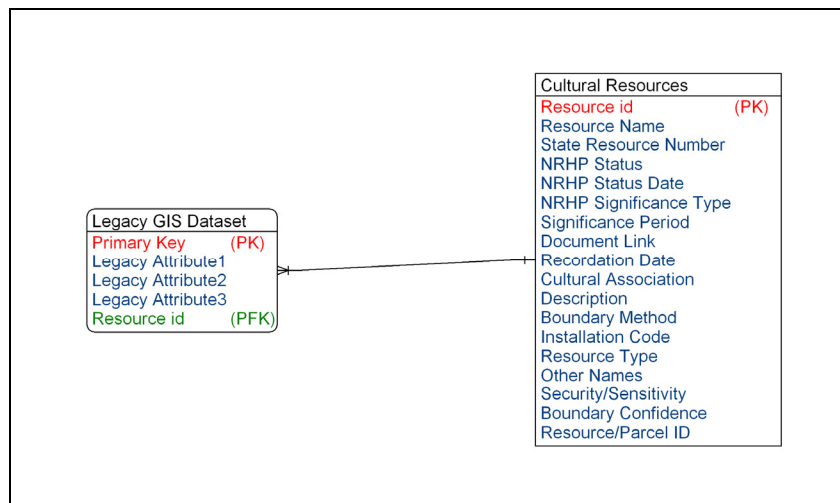


Figure 4: Example existing legacy dataset linked to a DoD draft standard compliant cultural resources business database directly, rather than via an SDSFIE compliant spatial table as in Figure 3.

By leaving legacy data in its present form, but collecting standard metadata about those data, and storing both the data and the metadata in a way that they can be preserved, discovered, and used, the status quo will be much improved. However, even with clear metadata collected and available, compiling information up the chain of command would still be more difficult than if the data are collected in a consistent format.

Going forward, there are steps that DoD can take to help preserve their data, and make those data easier to use.

- Articulate clear policy regarding funding for the collection, storage, and maintenance of digital data. The services should develop standards for the curation of existing datasets. At a minimum, basic metadata needs to be collected for these data, and storage protocols developed so that the data are retained.
- Develop policies for the curation of digital data along with artifacts and field records from archaeological projects and include the requirement with project scopes of work.
- Release and actively implement Version 3.0 of the SDSFIE. At a minimum, the components should mandate that installations include a requirement in scopes of work that GIS data supplied as a deliverable be compliant with the SDSFIE 3.0 (www.sdsfie.org).
- Installations should stipulate that associated business data be supplied in a relational database, or in tables compliant with the draft DoD cultural resources business data standard. Draft cultural resources business data standards can be found in Legacy Report 08-369: (https://www.denix.osd.mil/portal/page/portal/CR/GIS/Other/08-369_Summary_final.pdf). Key elements of the business data would include site and eligibility data, and report and survey references.

These tasks can be undertaken as time and funding allow, but should not be postponed for long; and they will need to be directed by clear policy decisions regarding storage protocols. The DoD has over the years collected a very impressive body of cultural resources information. Properly curated, these data can be a crucial component of cultural resources knowledge for many generations.

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APPENDIX A: TABULATED SURVEY RESPONSES

Table A.1: Types of Cultural Resources Data in Digital Format

Respondent Organization	Archaeological Sites		Archaeological Survey/Evaluations		Archaeological Collections		Consultation		Buildings	
	Primary	Secondary	Primary	Secondary	Primary	Secondary	Primary	Secondary	Primary	Secondary
CEMVS-EC-Z	ArcGIS	Other	ArcGIS	Oracle	ArcGIS	Oracle			Access	Excel
St Louis District, USACE	ArcGIS	Access	ArcGIS	Access						
NAS Meridian			Unspecified	Unspecified			Unspec.	Unspecified	Unspec.	Unspecified
Unspecified	Access	Other	Access	Other	Access	Other	Access	Other	Access	Other
U.S. Air Force Academy	Other	ArcGIS	Other		Other	Excel	Other		Other	
U. S. Navy, NAVFAC, MIDLANT	ArcGIS	Access	ArcGIS	Access	Other	ArcGIS			Access	
Barksdale AFB, LA	Excel	Other	Other		Excel	ArcGIS	Excel	Other	Other	
HQ AMC	Other		Other		Other		Other		Other	
Holloman AFB	ArcGIS									
Nellis AFB, NV	Excel	ArcGIS	Excel	ArcGIS	ArcGIS	Other	Excel		Other	
Whiteman AFB					Other	Other				
Picatinny Arsenal	Excel	ArcGIS	ArcGIS	Excel	Excel	ArcGIS	Excel		Excel	ArcGIS
USAF	Excel	Other	Excel	Other	Excel		Excel		Excel	
Minot AFB					Other				Other	
Andersen AFB										
Elmendorf AFB	Other		Unspecified		Excel	Other				
Shaw AFB	Unspecified		Unspecified		Unspecified		Unspec.		Unspec.	
PACAF										
NAVFACMW CRANE	Other	ArcGIS	Other	ArcGIS	Other	ArcGIS	Other		Other	
Tinker AFB	Excel	Other	ArcGIS	Other	ArcGIS	Excel	Excel	Other	Other	
Mountain Home AFB	Other	ArcGIS	Other	ArcGIS	Excel	Other	Excel	Other	Other	
NCBC										

Respondent Organization	Archaeological Sites		Archaeological Survey/Evaluations		Archaeological Collections		Consultation		Buildings	
	Primary	Secondary	Primary	Secondary	Primary	Secondary	Primary	Secondary	Primary	Secondary
GULFPORT										
NASP	ArcGIS		ArcGIS		ArcGIS		Excel		Other	
Unspecified	ArcGIS	Excel	ArcGIS	Excel						
NAS Whiting Field					Other					
Arnold AFB	ArcGIS	Excel	ArcGIS		ArcGIS	Other	Excel	ArcGIS	Other	Excel
Hill AFB	ArcGIS	Oracle	ArcGIS	Oracle	Excel	ArcGIS	Access	Excel	Other	Other

Respondent Organization	Native American Consultation		Burials		Mitigations		Sacred Sites		Other
	Primary	Secondary	Primary	Secondary	Primary	Secondary	Primary	Secondary	
CEMVS-EC-Z			ArcGIS	Oracle	Access	Other			administrative data (contracts, funds, contacts, scheduling)
St Louis District, USACE					Other	Other			Hard copy
NAS Meridian									Unspecified
Unspecified	Access	Other	Access	Other	Access	Other			GeoMedia and Geomedia Pro
U.S. Air Force Academy									Microsoft Word, Adobe PDF
U. S. Navy, NAVFAC, MIDLANT			ArcGIS	Access	ArcGIS	Access	ArcGIS	Access	Environmental Compliance reviews data (Access)
Barksdale AFB, LA			Other						
HQ AMC			Other		Other				Word - in process for creating Access database and loading data to GIS
Holloman AFB									

Table A.2: Types of Cultural Resources Data in Digital Format (cont.)									
Respondent Organization	Native American Consultation		Burials		Mitigations		Sacred Sites		Other
	Primary	Secondary	Primary	Secondary	Primary	Secondary	Primary	Secondary	
Nellis AFB, NV	Other		Other	ArcGIS	Excel		Other	ArcGIS	Public Outreach creativity incl videos & pubs
Whiteman AFB									
Picatinny Arsenal			ArcGIS						
USAF	Excel								
Minot AFB									
Andersen AFB									
Elmendorf AFB					Other				ACES
Shaw AFB									
PACAF									
NAVFACMW CRANE			Other	ArcGIS					
Tinker AFB					Excel				Word
Mountain Home AFB					Other				Hard copy / electronic reports
NCBC GULFPORT									
NASP	Other		ArcGIS		ArcGIS		ArcGIS		
Unspecified									Monuments/Marker/Me morials
NAS Whiting Field									
Arnold AFB			ArcGIS	Other					
Hill AFB					Other	Other	Other	Other	

Table A.3: Cultural Resources Data Questions							
Respondent Organization	Question 2: Types of data not managed?	Question 3: No. of Resources Managed	Question 3: Amount of storage space used.	Question 4: Who maintains data?	Question 5: Are data actively maintained?	Question 6: Where are data maintained?	Question 7: What data are in installation GIS?
CEMVS-EC-Z	No			cultural resources manager, GIS specialist (both within USACE)	yes through project funding	LAN, desktop, external hard drive	sites and surveys are maintained within the district GIS with restricted access
St Louis District, USACE	No	>1000	Unknown	Self with updates from SHPO	As needed, no specific funding	LAN and desktop	not applicable
NAS Meridian	Yes all the surveys, ICRMPs are paper with more recent ones in Word or PDF	< 100 Resources/ Records	63.5 MB	Forester in Public Works with collateral duties as a CRM	Yes, I store new survey reports and data as received. My salary is funded 67% from forestry and 33% from Environmental to do CRM and a dozen other things	Desktop backed up to a external hard drive	I have made an archeological layer from the surveys and ICRMP in point showing all sites and in polygon showing all the significant sites
Unspecified	None	>500	106GB	Data analyst	Yes; project dollars	Server farm	Cemetery, Area of cultural concern, District, Historic buildings
U.S. Air Force Academy	No	100 percent	3 GB	10 CES/CECP and USAFA/CEAOP	Yes, GIS and Geobase	NETWORK	cliff dwelling point, cultural study point, terrest study point, historic point 1, historic point 2, rock art point, milling point,

Table A.3: Cultural Resources Data Questions							
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							cultural survey 1 and version 2, cultural study line, historic feature line, terrest archeo feature line, cultural study line 2
U. S. Navy, NAVFAC, MIDLANT	no	> 10000 resources	Undetermined	Regional Historic Preservation Officers (same thing as CRM)	Yes, through various means - primarily through staff, some by contracts	access-restricted LAN	hierarchial need-to-know system in GIS, some users see less, some users see more
Barksdale AFB, LA	No			2 CES/CEAO	Yes, via studies funded by ACC	LAN and CDs	Historic Building Data, Archaeological Site Locations
HQ AMC	training status of base CRMs - will be included within Access database above	lots, number TBD	TBD - only have a few electronic ICRMPs	TBD - it's the bases that should, but will probably default to me till central web-based system on-line. Bases will maintain GIS after my initial command-wide contract is complete.	via ICRMP updates and MDL/MDS standard title project. Funded via EQ (besides in-house efforts).	TBD except IGI&S will be maintain on LAN (except specific archaeological site locations for Little Rock since that CRM has a personal CPU with appropriate software - nobody else does.	Layer is a misnomer. Data are data and "layer" is the4 construct used to discuss which pieces of data are pulled together. For purposes of this questionnaire, I think this is a misleading question. Cul res data is relevant to

Table A.3: Cultural Resources Data Questions							
Respondent Organization	Question 2: Types of data not managed?	Question 3: No. of Resources Managed	Question 3: Amount of storage space used.	Question 4: Who maintains data?	Question 5: Are data actively maintained?	Question 6: Where are data maintained?	Question 7: What data are in installation GIS?
							culr res mgt, constraints determination, and basic General Plan-related displays. "Constraints" goes to NIA, dig permits, siting, etc. All data with a geographic relationship will be within the IGI&S (specifically or as metadata).
Holloman AFB	90% or better of our paper records. Better attribution and site extents.	283	<10 Megabytes (feature class)	Geographer	Not actively maintained.	Centralized ArcGIS Database (GeoBase)	terrest_archeologic_point - feature class (under cultural feature dataset) Site location with unique id tied to paper records
Nellis AFB, NV	A 30,000 original storage photo & video library of 50G on separate backup drives	5,000 records & reports	24 G	99 CES/CEANS - Cultural Resources Manager	Updating of databases twice a year; average 1 in 4 years contracted geobase update; funded annually under Curation	Originals kept on Desktop, monthly backup to LAN, periodic backup to 2TB Hard Drive at CRM desk	Layer of Sites, Layer of survey boundaries and SHPO consultation results
Whiteman AFB	no	<100	0	Asset Mgmt	No	LAN	None

Table A.3: Cultural Resources Data Questions							
Respondent Organization	Question 2: Types of data not managed?	Question 3: No. of Resources Managed	Question 3: Amount of storage space used.	Question 4: Who maintains data?	Question 5: Are data actively maintained?	Question 6: Where are data maintained?	Question 7: What data are in installation GIS?
Picatinny Arsenal	No	100-200 Resources	~80+/- GB	Cultural Resources Manager (1 person)	Yes. GIS maintenance is somewhat lacking. IMCOM funded	Desktop, Server and GIS computer	Archaeological Site Data, Survey Area, Historic Bldgs, Cemetery
USAF		100-500	Unk	AFCEE	Y; annual O&M funds	Desktop and LAN	Summary data pulled /compiled from installation and command GIS
Minot AFB		<100		Cultural Resource Manager	Yes, unknown	LAN	None
Andersen AFB	Archaeological site data	Unspecified	Unspecified	36 CES/CEV	As needed	CES Q drive	In progress
Elmendorf AFB	Memorandums of Agreement; Bldg pictures	200 resources	50 GB	Cultural Resources Manger and Real Estate	GS employee hours	Desktop	
Shaw AFB		<125		20 CES Cultural resource manager	yes ACC	CD/ desktop	Archaeological Site layer Arch site location
PACAF				Base level			
NAVFACMW CRANE	Historic photos, newspapers, articles, interviews	100-150	Unknown	Cultural resources manager	As needed	Desktop and cd	See above. Data layer is coded as "restricted".
Tinker AFB	No	32	36 Mb	72 CS and 72 ABW/CEA	Yes, Civil Engineering Asset Management computer support line item	ArcGIS Server, CS server, Desktop	Archaeological and Historic building data in the Cultural Resource layer

Table A.3: Cultural Resources Data Questions							
Respondent Organization	Question 2: Types of data not managed?	Question 3: No. of Resources Managed	Question 3: Amount of storage space used.	Question 4: Who maintains data?	Question 5: Are data actively maintained?	Question 6: Where are data maintained?	Question 7: What data are in installation GIS?
Mountain Home AFB		>6000	Unspecified	CEAN	Yes. Updated by CRM program.	Stand alone computer, CD's	Sites, isolates, survey reports included as layers
NCBC GULFPORT	No	None	None	NA	No	NA	NA
NASP	Archeological sites/surveys and historic structure data needs to be updated for current management	67 archaeological sites & 207 eligible historic structures/		CRM/HPO/ Contractor	Data requires updating. POM EPR Web	CD/other	Archeological sites and historic structures
Unspecified		<100	2 GB	Natural Resources Manager	Manually	LAN	Archeological site locations as shapefiles
NAS Whiting Field	2000 ICRMP	Unknown		CR Manager: I cover this area as part of my position, Environmental Specialist, Natural Resource Manager and Cultural Resource Manager. I have no training in this area.	No	Unknown	

Table A.3: Cultural Resources Data Questions							
Respondent Organization	Question 2: Types of data not managed?	Question 3: No. of Resources Managed	Question 3: Amount of storage space used.	Question 4: Who maintains data?	Question 5: Are data actively maintained?	Question 6: Where are data maintained?	Question 7: What data are in installation GIS?
Arnold AFB	No	500-1000 resources	~15 MB	Conservation Data Manager	Yes, funding is supplied through Environmental funds for GIS administration and maintenance	LAN	Listed as ArcGIS are stored in the Environmental GIS
Hill AFB		500+ resources	8.8 GB	75 CEG/CEV, Archaeologist, SES, GIS Specialist	Yes, maintenance funded through AF contracts	LAN and Desktop	historic buildings, historic districts, archaeological sites data and inventory areas, historic military sites and areas in various layers

Table A.4: Cultural Resources Documents Questions					
Respondent Organization	Number of Documents	Linear Ft of Documents	Electronic Storage	Does CR Manager have copies?	What percentage of documents hard copy only?
CEMVS-EC-Z					
St Louis District, USACE	>100	>20	unknown	No, lake projects maintain some documents.	90
NAS Meridian	148	1	347	Yes, but NAVFAC SE should have most of them as well, Len Winter or Darrell Gundrum.	10
Unspecified	>1000	Unknown	Included above	Yes	100

Table A.4: Cultural Resources Documents Questions					
Respondent Organization	Number of Documents	Linear Ft of Documents	Electronic Storage	Does CR Manager have copies?	What percentage of documents hard copy only?
U.S. Air Force Academy	22	4 feet	3 gb	Cultural Resources Manager and Community Planning manages and stores these documents	15
U. S. Navy, NAVFAC, MIDLANT	A lot - cannot quantify at this time	Unknown	Unknown	CRM has access to documents, but does not have hard or electronic copies of all at this time, moving that direction though	unknown
Barksdale AFB, LA	25	3.1		Yes	45
HQ AMC			Under Development	They better! As HQ AMC CRM, I have some, but not all. Working on getting electronic access to all.	TBD, but numerous
Holloman AFB				Yes	
Nellis AFB, NV	220	24	20 G incl sptng docs	CR Manager has hard copy and digital originals of all - pre-1995 reports are scanned	0
Whiteman AFB	15	8	0	Do not have a CRM	100
Picatunny Arsenal	~30		~20GB (guess)	Yes	75
USAF	Hundreds	Unk	Unk	Some; installation and command CRMs have their own	60
Minot AFB	<100	25	Unknown	Yes	75
Andersen AFB	unknown			Yes	100
Elmendorf AFB	7 in 2009	1	4 GB	Yes	15
Shaw AFB	A guess 100	25	?	Yes SHPO SCIAA ACC	50
PACAF					

Table A.4: Cultural Resources Documents Questions					
Respondent Organization	Number of Documents	Linear Ft of Documents	Electronic Storage	Does CR Manager have copies?	What percentage of documents hard copy only?
NAVFACMW CRANE	Too Many To Count	30 (APROX)	Unknown	Yes. Copies of most stored at code 0592 env. Bldg-3260	50
Tinker AFB	42	4	32 Mb	Yes	0
Mountain Home AFB	>100	35 - 40	?	yes. Idaho SHPO manages copies as well	100
NCBC GULFPORT	None	None	None	NA	NA
NASP	389	28.75		HPO/Contractor	25
Unspecified	<10	<1	200 MB	yes	0
NAS Whiting Field	2	4 inches		Environmental Manager	100
Arnold AFB	56	5	~1 GB	Yes	8
Hill AFB			40 GB	Yes	5