Operationalizing the United States Department of the Air Force Digital Archives

by

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Abstract

This paper analyzes the current state of digital curation within the United States Air Force History and Museums Program and evaluates the lifecycle of Air Force digital records. The scope of this evaluation includes information from existing literature, in-the-field personnel, and named experts to generate an independently understandable archival needs assessment. The paper supplies numerous synopses of American and international digital archive models and standards to create a baseline understanding of the benefits of digital curation. In contrast, the research generates several Air Force case files highlighting the need for standardization and training across the force. The study delivers a controlled and measurable appraisal of the current state of digital asset management and information packaging employed by the Air Force. The analysis concludes by recommending the courses of action the Air Force History and Museums Program must implement to operationalize and connect the global network of United States Air Force digital archives.

Keywords: United States Air Force | Digital Curation | Information Packaging | Preservation Service | Interoperability | Digital Preservation | Data.

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Operationalizing the United States Department of the Air Force's Digital Archives

The way Institutional Repositories (IR) approach cultural and corporate memory preservation is rapidly changing. The relationship between human memory and how we record that memory is moving away from the historical norm of analog publications and tangible documentation. The long-term preservation of information now requires different standards and technology to ensure future generations can access, make sense of, and use digital objects. Today's preservation challenges in the archival community are intensified when exploring the complexities of protecting the corporate memory of modern military forces. Managing, preserving, and disseminating government records "ensures transparency and accountability in government actions" (Soyka & Wilczek, 2014, p. 176). However, government datasets branch across a spectrum of current diplomatic, informational, military, economic, and cultural (DIME-C) topics. Any improper management or protection of current government records places individual lives at risk.

In 2022 the United States Armed Forces Services Committee – Subcommittee on Cyber, Innovative Technologies and Information Systems recognized that defense historical reporting needed reevaluation (United States House of Representatives, 2022, p. 49). The Subcommittee challenged all primary military archives to build the necessary infrastructure and develop digital services that increased access and use of defense historical collections (United States House of Representatives, 2022, p. 49). This report is limited to addressing the challenges and concerns associated with preserving and protecting the corporate memory of the Department of the Air Force (DAF), which includes born digital and digitized records of the United States Air Force (USAF) and the United States Space Force (USSF). This report does not address recordkeeping issues within other branches of the Department of Defense or the DAF's external stakeholders.

Currently, there is not a plethora of literature on Air Force archives and the historical program. Most of the corporate knowledge about the DAF's historical practices remains unpublished and locked in the memory of those who built the existing organization. Therefore, designing a reliable research framework requires combining a subject-specific literature review and detailed interviews with subject matter experts to answer the following questions: How do the United States Air Force and Space Force Field History Offices influence the lifecycle of digital defense historical records, and how can the Air Force History and Museums Program (AFHMP) improve its digital information packaging? Within this question, the following sub-questions are asked: What are other government agencies suggesting as recommended digital curation workflows? And are cloud-based data enclaves realistic for long-term storage and access to controlled data?

This research intends to provide DAF heritage professionals with a foundational overview of digital curation. The report highlights several examples, developed in-country and internationally, to establish how digital curation services operate in similar institutions. The research then contrasts three case studies investigating the current operating environment within the Air Mobility Command History Office (AMC/HO), the Air Force Special Operations Command History Office (AFSOC/HO), and the Air Force Historical Research Agency (AFHRA). The finding generated from this research document the needs of the DAF internal community and offers recommendations for operationalizing the Department of the Air Force digital collections.

Methodology Overview: Lessons from the Trenches

This research aimed to understand the lifecycle of AFHMP digital records and document how DAF heritage professionals understand, approach, and interact with born digital and digitized records. A landscape review offered the opportunity to interview people in several roles

throughout the Air Force History and Museum Program to understand the current operating environment better. The process began with desk research studying digital curation and preservation trends in the international archival community. This portion of the study consulted published literature, news articles, reports, and other secondary sources to uncover various tools, training, and techniques employed by cultural heritage with similar environmental constraints and user needs. Over the course of this semester, information was collected from Mr. Timothy Brown, Director of the Air Force Historical Research Agency; Mr. Charles Newell, Director of History and Heritage for the US Southern Command History Office; and Mr. Thomas Lauria, Supervisory Historian for the USAF Expeditionary Center History and Heritage Office. The AFSOC History team included Mr. James Gildea and Mr. Todd Schroeder, the senior historians, Mr. Stuart Camp, editor, and Ms. Jessica Forsee, Palace Acquire Historian Intern.

The landscape and literature reviews were followed by three detailed interviews with AFHMP heritage professionals who directly influence decision-making within the Department of the Air Force history and heritage programs. Subject matter experts (SMEs) from the Air Mobility Command History Office (AMC/HO), the Air Force Special Operations Command History Office (AFSOC/HO), and the Air Force Historical Research Agency offered insightful data specific to their IRs during extensive interviews to generated three individual case files. The interview information supplemented the gaps in published literature and attempted to capture the current obligations and constraints impacting the AFHMP. The interviewees selected for detailed interviews were: Mr. Jeffery Michalke, the command archivist for the AMC History Office managing the AMC archives, airparks, and artwork; Mr. Eric Witt, the AFSOC History Office's the Director of History and Heritage; Mr. Christopher Horton, AFHRA's Information Technology Team Lead; and Ms. Maranda Gilmore, the Deputy Director for AFHRA. The three case studies outline how AMC, AFSOC, and AFHRA's heritage professionals confront the

realities of long-term preservation and internal information sharing within its unique military environment.

The interview framework employed the existing archival models and recommended assessment tools to develop a digital preservation inventory and case file on each DAF digital archive. The interviews consisted of two segments: a collections inventory (structured) and an information interview (unstructured). Each interviewee answered the collections inventory portion based on their knowledge of digital curation. The collections interview segment established how each organization approached the long-term preservation of digital assets to determine how they interpreted their digital holdings and the existing DAF information packaging process. The structured responses are recorded in the first appendix of this report. After completing the structure questions, interviewees were prompted to elaborate on how their offices are uniquely organized, trained, and equipped to manage digital assets. The main topics covered during these conversations included: the archive's current practices and obligations, organizational readiness, financial and technological constraints, and additional training needs.

The Past: Situation Report and Landscape Review

As the primary holders of the DAF's institutional memory, the Air Force History and Museums Program strives to capture, preserve, and disseminate USAF history and heritage. The AFHMP consists of four major components. The Office of Air Force History and Museums (AF/HO) leads the program by generating policies and plans for sustaining USAF history and heritage. The Air Force Historical Research Agency (AFHRA) at Maxwell Air Force Base, Alabama, maintains the USAF's textual collections. The USAF Heritage Program is a network of government museums dedicated to preserving and interpreting the USAF's tangible heritage. Finally, the Worldwide History Program includes an array of wings, groups, numbered air forces, laboratories, centers, direct reporting units, field operating agencies, and major

command history offices – all of which gather, analyze, interpret, and preserve historical documentation and information (Grudzinskas, 2016, pp. 2-7). Together, these departments "save the present, preserve the past, and inform the future" (AFHMP, 2022).

When the DAF mission expanded in 2019 to include the United States Space Force (USSF), the AFHMP assumed the added responsibility of preserving the historical data of the only military service established during the Information Age (Raymond, 2021, p.2). As DAF strategic guidance shifts toward becoming digitally dominant during the Information Age, AFHMP leaders and innovators must examine the program's capacity to preserve "an accurate and objective account of our present experience" in a digital operating environment (Dysart, 2012, pp. 2-3). Despite a long-standing precedent for managing USAF records, the AFHMP must overcome the complexities of establishing an archival infrastructure that ensures the long-term preservation and security of digitized and born-digital war records. This report explores the challenges of innovating the current AFHMP infrastructure into a system where heritage personnel can create, manage, disseminate, and protect operational documents for future generations. It does not fully address the complexities of preserving the material culture or the legalities of granting civilian-sector access. Instead, it explores avenues to increase DAF historians' and archivists' interoperability and digital fluency to provide future military commanders with a strategic advantage on a multi-dimensional battlefield.

Crafted In the Heat of Battle – DAF History & Heritage

Crafting historical reports while military operations occur is not a new concept. "Historians have been 'embedded' with combat forces on the battlefield at least as far back as the time of Thucydides, the fifth-century Greek historian and general" (Neufeld, 2010, p. 45). "The leadership of the United States Air Force and its predecessor organizations valued the force's history and heritage from the early days of military aviation in the United States" (AFHMP,

2019, p. 1). Ensuring the history program remained staffed, funded, and accessible to every level of command took generations of Air Force leaders advocating on its behalf.

"In February 1918, the War Department formed a Historical Branch of the General Staff to document the course of World War I" (Dysart, 2012, p. 1). "Regulations required each component organization to prepare a history and forward it to the Historical Branch" for information packaging and publication (AFHMP, 2019, p. 1). The regulation sparked the creation of American defense historical reporting. Several military leaders acknowledged that to form a foundation for the development of military aviation," future servicemembers must have access to "draft volumes of unit commander reports, narratives, orders, operations reports, digests, statistics, photographs, and miscellaneous items provided by the units" (Dysart, 2012, p. 1).

In 1942 under the direction of President Franklin D. Roosevelt, the War Department established the Committee on Records of War Administration to" '[preserve] for those who come after us an accurate and objective account of our present experience.'" (Dysart, 2012, pp. 2-3). At the President's direction, "each Federal agency involved in war activities" received orders to appoint a historian to "maintain an administrative history of those activities" (Kennedy, 1954, p. 124). The presidential mandate fueled the younger Army Air Force Generals to advocate for professional and unbiased historical reporters. Army Air Force Generals argued: "it is important that our history be recorded while it is hot and that personnel be selected and an agency set up for a clear historian's job without an axe to grind or defense to prepare" (Kennedy, 1954, pp. 124-125). Throughout World War II, hiring a professional historian required Army Air Force leaders to embrace change and recruit heritage professionals. "A number of professionally trained historians who joined the US Army Air Force (USAAF) during the war worked in the Historical Division," producing "studies and reports, many of them classified, during and after

the war" (AFHMP, 2019, p. 2). The curation initiatives from these early field historians provided future Airmen with a foundational “understanding of airpower during World War II" (AFHMP, 2019, p. 2). Since the creation of the United States Air Force (USAF) in 1947, "the history program changed names and organizational homes, at various times being part of the intelligence, information, and operations functions" (AFHMP, 2019, p. 3). In August 2002, Lieutenant General Joseph Wehrle, Jr., the USAF Assistant Vice Chief of Staff, indicated that the Air Force should “rethink its processes and accomplish an organizational shift to support the current operations and look to the future” (AFHRA, 2004). Wehrle directed the program to digitize the “most current” documents and records that best supported existing combat commanders and planners (AFHRA, 2004). The intent of digitization allowed AFHRA to transition the paper records to the National Archives and Records Administration (NARA) to ensure space for incoming documents. However, NARA’s transition from paper began in 2003, disrupting the effort. Even still, 2003 saw the AFHMP’s shift away from being an active-duty force embedded inside another function. Instead, the history program "transitioned to all civilians except for some of the remaining Reserve billets" (AFHMP, 2019, p. 3).

In AFHMP 2016 Strategic Plan, Walter A. Grudzinskas, the former Air Force History and Museums Program Director, stated:

> In a world full of uncertainty and change, history and heritage are constants Airmen can rely on. Therefore, the mission of AFHMP is to improve USAF combat capability and program development through the collection, preservation, interpretation, dissemination, and display of historical information, artifacts, and Air Force heritage to commanders, staff, other government officials, the public, and the media (Grudzinskas, 2016, pp. 2-7).

Today, civilian historians are embedded into the USAF organizational structure through the Worldwide History Program, functioning as historians and archivists. These heritage professionals leverage the continuous use of pre-existing knowledge to improve decision-making and operational effectiveness. The program's ability to prioritize and answer the organization's strategic questions accurately and quickly supplies an unmatched resource to modern USAF commanders. Historic datasets curated by DAF historians, archivists, editors, and museum curators routinely "answer inquiries from Congress, the White House, other federal agencies and departments, internal Air Force and Space Force sources, and the American public" (Grudzinskas, 2016, p. 9). Each DAF History Office preserves a repository specific to its organization's cultural heritage. However, the complete and official copies of all DAF organizational history files for active and inactive units are preserved by AFHRA personnel at Maxwell AFB, Alabama (M. Gilmore, personnel communication, May 5, 2022). As DAF personnel branch into the digital operating environment, the AFHMP "must develop the resources to reinforce the value of history and heritage to support ongoing planning and operations around the globe" (Grudzinskas, 2016, p. 10).

Embracing the Fifth Dimension of Warfare

The United States military recognizes several battlefield operating environments as warfare dimensions. The four traditional (Grudzinskas, 2016)dimensions (land, sea, air, and space) expanded in 1995, when "the secretary and chief of staff jointly signed the Foundations of Information Warfare which laid out basic definitions and principles for how the Air Force would work in cyberspace" (Healey, 2012, p. 12). The Air Force went on to establish its first cyber unit, the 609th Information Warfare Squadron, at Shaw Air Force Base in 1996 (Healey, 2012, p. 12). The 609th intended to "operationalize information warfare on behalf of the joint force air

component commander (JFACC) and the fighting forces," and the unit established the first "information condition" (INFOCON) standards (Healey, 2012, p. 12).

In 2008, then-USAF Major General William T. Lord, commander of Air Force Cyber Command (Provisional) (AFCYBER [P]), published his thoughts on the relatively new dimension of cyber warfare. Maj Gen Lord detailed that understanding and integrating cyber warfare into current operations mandated that USAF personnel approach this dimension differently than its traditional counterparts (Lord, 2008, pp. 6-7). Even still, this operating environment demanded new rules of engagement that prioritized access to trustworthy information (Lord, 2008, pp. 6-7). Maj Gen Lord asserted that every Airmen in today's force needed to develop "cyber-mindedness," and effectively doing so required supplemental training abnormal to the traditional warfare domains (Lord, 2008, p. 14).

Jason Healey, the Director of the Cyber Statecraft Initiative Atlantic Council, built on Maj Gen Lord's concept of "cyber-mindedness," adding that "the service is likely to continue to relearn old lessons and struggle under misperceptions" since cyber heritage is not explicitly taught to Airmen. Healy defined "cyber-mindedness" as "a collective sense of the history, dynamics, possibilities, and limitations of cyber conflict" (Healey, 2012, p. 16). In his article published in *Strategic Studies Quarterly,* Healy articulated critical concerns about the lack of cyber heritage being collected by the USAF and across the Department of Defense (Healey, 2012). According to Healy, "the USAF has a longer, more distinguished heritage in the cyber domain than any other military in the world" (Healey, 2012, p. 16). However, unlike its traditional counterparts, the lessons learned within the fifth dimension of warfare have "been forgotten and ignored as irrelevant" because Airmen are not taught about the lessons of cyber space (Healey, 2012, p. 11). Healy asserted that "few, if any, Airmen involved in cyber operations

today are likely to remember the major cyber conflicts, pioneering cyber leaders, doctrine, or units of the past" (Healey, 2012, p. 11).

On October 1, 2009, the defense sector unified joint operations in the virtual battlespace with the activation of the US Cyber Command (USCYBERCOM). USCYBERCOM "brought together computer network attack (CNA) and computer network defense (CND) activities of the Joint Functional Component Command for Network Warfare (JFCC-NW) and the Joint Task Force for Global Network Operations (JTF-GNO) under USCYBERCOM" (Jabbour, 2010, p. 63). Today military operations, especially those involving USAF personnel, include a complex network of electronic systems that branch into every combat domain. According to Dr. Kamal Jabbour, the Air Force Research Laboratory – Information Directorate's principal authority on information assurance and warfare, "assuring missions and information and trusting systems and data provide the foundation for global vigilance across the spectrum of conflict" (Jabbour, 2010, p. 65). However, Jabbour argued that American military forces cannot dominate cyberspace until military education and training deliberately incorporate cyber force developments. Despite approximately 27 years of perfecting cyber capabilities, today's Airmen cannot reliably access and learn from cyber heritage. This lack of information forces the modern cyber warrior to "repeat the same mistakes and relearn old lessons," thus squandering critical time in the heat of battle (Healey, 2012, p. 18). Dr. Jabbour reasoned that "deliberate cyber force development gives the USAF an opportunity to lead the nation in growing engineers. The scientific and mathematical complexity of computer and network systems, the critical dependence of USAF essential functions on their proper operations and the uncertain risk… mandate a relevant formal…education as the entry point into a cyber force" (Jabbour, 2010, pp. 70-71). To understand the demands of cyber warfare and meet the educational needs of cyber professionals, USAF history and heritage personnel must adapt to "fly, fight, and win in cyberspace" by effectively integrating cyber-mindedness into their lexicon (Healey, 2012, p. 17).

Even still, the AFHMP must develop a digital infrastructure that ensures the complexities of cyber operations and its valuable historical material are preserved within DAF's official records.

Accelerating Change and Determining Readiness

Based on *The Fundamentals of Military Readiness,* the "DoD officially defines the term "readiness" in Joint Publication 1 (JP 1) as the ability of military forces to fight and meet the demands of assigned missions" (Herrera, 2020, p. 3). The Congressional Research within *The Fundamentals of Military Readiness* outlined how the defense community repeatedly brands "readiness" as the ability of a military force to demonstrate three essential tasks – "organizing, training, and equipping (OTE) military forces" (Herrera, 2020, p. 9). Studies by the Federal Bureau of Investigation (FBI) argue that "slow-to-adapt government institutions" set back efforts to counter enemy information operations (Rogers, 2021, p. 96). Even still, leaders from the Defense Advanced Research Projects Agency highlighted, "the nature of interactions with the information environment [is] rapidly evolving, and old models are becoming irrelevant faster than we can develop new ones. The result is uncertainty that leaves us exposed to dangerous influences without proper defenses" (Rogers, 2021, p. 96).

Much of the emerging technology and services employed by military service members are no longer created or funded by the Department of Defense. In 2012, then-Lieutenant General John E. Hyten spoke about the challenges associated with building the infrastructure to support space and cyberspace in a contested environment. At that time, Lt Gen Hyten served as the Vice Commander for Air Force Space Command when he noted that successfully supporting cyber and space warfare required "the service's space and cyber commands to change their cultures" and accelerate past "the status quo established by past successes" and posture the force to meet the needs of rapid innovation (Albon, Hyten Calls for Innovation, Culture Change In USAF Space and Cyber, 2012, p. 7). Hyten went on to "criticize the Air Force's acquisition

process as too slow-moving for the pace of the cyber world" (Albon, Hyten Calls for Innovation, Culture Change In USAF Space and Cyber, 2012, p. 7). His chief complaint stemmed from how quickly cyber innovation made digital science and technology obsolete (Albon, Hyten Calls for Innovation, Culture Change In USAF Space and Cyber, 2012, pp. 7-8). Shortly after publishing these comments, the Air Force Space Command began networking with civilian companies to improve infrastructure gaps (Albon, 2018, p. 3). By 2018 the Space and Missiles Systems Center "started working with tech and gaming companies to get at the technology issues associated with better virtual reality and threat simulation development" (Albon, 2018, p. 3). According to Dr. Jabbour, senior scientist at AFRL, "budgetary pressures compounded the slide away from assured government off-the-shelf (GOTS) stand-alone weapons towards affordable commercial-off-the-shelf (COTS) networked systems (Jabbour, 2010, p. 64).

"Across the DoD, each Service [and Agency develop] a variety of metrics and measures to assess the readiness of its forces," and these assessment frameworks have an exponential impact on Congressional funding decisions (Herrera, 2020, pp. 37-38). The critical concern with the existing readiness frameworks stems from a "lack of commonality and uniformity…used across similar military units" (Herrera, 2020, p. 37). In 2019, the DoD published its *Digital Modernization Strategy,* which stated that "[Digital Modernization] will enable increased lethality for the Joint warfighter, empower new partnerships that will drive mission success, and implement new reforms enacted to improve capabilities across the information enterprise" (Raymond, 2021, p. 3). According to USSF General John W. Raymond, Chief of Space Operations, the DAF's operations in "field space, counter space, cyberspace, and electromagnetic spectrum (EMS) capabilities" uniquely position the department to function as a "Digital Service" in comparison to the other military departments (Raymond, 2021, pp. 2-4). To ensure a trustworthy digital infrastructure, Gen Raymond called for a "cultural transformation" that would "rethink archaic policies and processes that inhibit our ability to adapt and innovate"

(Raymond, 2021, p. 4). Gen Raymond outlined his vision the USSF as “an interconnected, innovated, and digital dominant force” while noting that this transformation must be DAF wide since the USAF and USSF share a digital infrastructure (Raymond, 2021, p. 4). Several DAF leaders encouraged establishing constituent connections with allies and industry leaders (Raymond, 2021, p. 5). Gen Raymond, USSF Chief of Space Operations, and Lt Gen John Shaw, USSPACECOM Deputy Commander, encouraged Airmen and Guardians to “increase [the] usage of commercial data” by establishing targeted partnerships with industry leaders and seek out “academic institutions to provide opportunities for degrees and certifications” to advance research and development (Raymond, 2021, p. 5).

In August 2020, the United States Air Force Chief of Staff, General Charles Q. Brown, Jr., published his vision for the future operating environment that he titled "*Accelerate Change or Lose*." This guidance charted the declining resource environment and placed significant pressure on USAF commanders to innovate rather than acquire new systems (Brown, 2020, pgs. 3-7). General Brown's guidance explicitly mentions, "the technology revolution dramatically changed how humans and economies interact in the world, and it has changed the way militaries can develop and project power" (Brown, Accelerate Change or Lose, 2020, p. 4). For Gen Brown, "past success…is no guarantee of future performance,” and the presumed American advantage will continue to erode if military organizations do not adequately prepare for the future operating environment (Brown, Accelerate Change or Lose, 2020, p. 4).

The Present: Archival Models and Literature Review

American Archives

“The Library of Congress defines digital preservation as “the active management of digital content over time to ensure ongoing access” (Corrado & Sandy, 2017, p. 3). Mr. Trevor Owens, the head of digital content management for library services at the Library of Congress,

expanded on the craft of digital preservation by stating “there are several models and frameworks for digital preservation practice and planning (Owens, 2018, p. 79). Edward M. Corrado, the Associate University Librarian for the Naval Postgraduate School, also wrote on the complexities of digital preservation activities within galleries, libraries, archives, and museums (GLAM) requires “a triad of interrelated activities: management-related activities, technological activities, and content-centered activities” (Corrado & Sandy, 2017, pp. 17-18). Several cultural heritage communities have published community standards and terminology, outlined best practices, and defined the limitations of shared solutions that must be considered and explored to understand the craft of digital curation (Owens, 2018, p. 79). The following section of this report reviews the growing corpus of literature addressing the complex challenges cultural heritage institutions face as they confront the triad of digital preservation activities.

Open-Archival Information System Reference Model

In 1995, the multi-national Consultative Committee for Space Data Systems (CCSDS) began developing standard terminology and concepts for the long-term archival storage of various data types during space missions. Under the auspices of the CCSDS, stakeholders from academia, government, and research organizations contributed their knowledge to create what is now called the Open Archival Information Systems (OAIS) Reference Model. This Committee included the major national space agencies of the world like the National Aeronautics and Space Administration (NASA), the Canadian Space Agency (CSA), and the European Space Agency (ESA). Today CCSDS is "composed of 11 member agencies, 32 observer agencies, and over 119 industrial associates" (CCSDS, 2022). As per Corrado and Moulaison Sandy’s *Digital Preservation for Libraries, Archives, and Museums,* “many, if not most digital preservation systems rely on the OAIS Reference Model” as an International Organization for Standards (ISO) standard (Corrado & Sandy, 2017, p. 23). See appendix B for the OAIS Reference Model Diagram.

OAIS provided a conceptual model of a successful digital repository and framework for describing digital materials. However, OAIS is not a prescriptive formula for all IRs. CCSDS assumed that implementers would use this reference model as a guide and modify it to provide services and content for their Designated Community. The conclusion from various experienced repository managers is that "the authors of the OAIS Reference Model created flexible concepts and common terminology that any repository administrator or manager may use and apply, regardless of content, size, or domain." (CCSDS, 2022).

OAIS established a formalized approach to analyze how digital objects change during their life cycle– they are called information packages (IPs). There are three types of information packages in the OAIS model: Submission Information Packages (SIPs), Archival Information Packages (AIPs), and Dissemination Information Packages (DIPs) (Lavoie, 2014, pp. 12-15). IPs are not static documents in the repository but represent living documents holding history and heritage. OAIS offers six functions: Ingest, Preservation Planning, Data Management, Archival Storage, Administration, and Access (CCSDS, 2012). Digital assets change as they travel through the repository and interact with each function.

"Since its adoption as both a Consultative Committee for Space Data Systems (CCSDS) and an ISO standard, the OAIS Reference Model has been welcomed and widely adopted by virtually all digital preservation communities. Most current digital preservation initiatives reference the OAIS Reference Model standard. Organizations have widely used it to inform their implementations of new or upgraded preservation systems" (CCSDS, 2022). Since this is the American model utilized by other space-related organizations, OAIS offers a baseline for designing digital preservation initiatives within the DAF archives.

National Archives and Records Administration – Trustworthy Auditing

"The National Archives and Records Administration (NARA) identifies, preserves, and provides access to the US Government's vast holdings of archival records" (National Archives and Records Administration, 2022, p. 1). In June 2019, the White House directed Federal agencies to "transition business processes and recordkeeping to a fully electronic environment and end the National Archives' acceptance of paper records by December 31, 2022" (US National Archives, 2022). Since then, NARA has diligently worked to "embrace the primacy of electronic records" (US National Archives, 2022).

In 2003, NARA participated in a joint task force “charged with developing criteria to identify digital repositories capability of reliably storing, migrating, and providing access to digital collections” (Lavoie, 2014, p. 23). The resulting audit checklist is the *Trustworthy Repositories Audit & Certification: Criteria & Checklist,* also known as TRAC (Lavoie, 2014). The auditing criteria combined concepts from OAIS and the ISO Trusted Digital Repository metrics to generate an ISO for accreditation and certification system (Giaretta, 2011, pp. 462-466). The TRAC checklist assesses IRs against three critical zones: “organization and governance; management of digital objects; and technology” (Lavoie, 2014, p. 23). This accreditation standard allows IRs to accurately demonstrate their compliance with the OAIS Reference Model.

NARA recently published the 2022-2026 Digital Preservation Strategy, reaffirming its commitment to "preserving and maintaining access to the content of all of the born-digital records and digital surrogates in their holdings" (National Archives and Records Administration, 2022, p. 1). Currently, "NARA holds several billion files representing more than 650 file format versions. These files can be categorized into 16 general categories of electronic records. Most files are email messages, followed by JPEG and TIFF still images and plain ASCII

text" (US National Archives, 2022). NARA's digital holdings include an extensive collection of USAF digital assets. USAF heritage professionals assigned to Geographic Combatant Commands operating in the joint military community use NARA's electronic records archiving services (C. Newell, personal communication, September 7, 2022). This existing connection provides a potential digital infrastructure framework and accreditation process with which the Air Force History and Museums Program can utilize and build (National Archives and Records Administration, 2022). "NARA is committed to collaboration with other national archives, libraries, and museums" (National Archives and Records Administration , 2022). Therefore, using the existing strategic connections and preservation frameworks built by NARA provide a potential avenue for cross-governmental strategic collaboration and increased interoperability with Defense Sector historical reporting.

United Kingdom Archives– Cooperating Archives at The Imperial War Museum

The United Kingdom (UK) was the first country to establish a Digital Curation Centre (DCC) "...to provide a national focus for research into curation issues and expertise in digital archiving, preservation, and management" (JSIC, 2014). The UK established the DCC through a joint effort by the Joint Information Systems Committee (JISC) and the Research Council's e-Science Core Programme (JSIC, 2014). DCC emphasized meeting users' needs and the Centre's outputs (JSIC, 2014). Over the years, DCC led the international GLAM network's attempts to create and develop tools and educational resources as digital preservation issues were identified.

In addition to the DCC, the Digital Preservation Coalition (DPC) operates as a UK-based non-profit that functions as an "advocate and catalyst for digital preservation, ensuring our members can deliver resilient long-term access to digital content and services" (Lavoie, 2014). The DCC and DPC routinely collaborate to train and equip professionals interested in digital archiving and preservation (Digitial Curation Centre, 2022).In 2014, Mr. Brian Lavoie and the

Digital Preservation Coalition expanded on OAIS, defining the standard functions an IR is responsible for maintaining. In the publication *The Open Archival Information System Reference Model: Introductory Guide,* Mr. Lavoie notes that “The OAIS reference model includes a discussion of different classes of interoperability across OAIS-type archives: independent archives, cooperating archives, and federated archives” (Lavoie, 2014, p. 2). Lavoie defines a cooperating archive as “two or more archives that maintain some form of submission or dissemination compatibility between them. More specifically, the archives support at least one SIP or DIP format used to fulfill requests made from one archive to another” (Lavoie, 2014, p. 19).

In 2013. the JISC-led Strategic Content Alliance published its findings on how well the Imperial War Museum reorganized to “centralize the digital management process” and explored “the way in which a major and complex organization centralized its digital strategy to create a sustainable infrastructure” (Maron, Yun, & Pickle, 2013, p. 15). In 2006 the Imperial War Museum (IWM) set out to combine 140 unique "databases into a central catalog as well as their current reconsideration of which activities are best served centrally and which require specific subject-area expertise" (Maron, Yun, & Pickle, 2013, pp. 38 - 41). IWM prioritized finding a system centralized system that could be accessed and used by approximately 600 staff members across "a family of five museums in England (three locations in London, one each in Manchester and Duxford)" (Maron, Yun, & Pickle, 2013, p. 40) (Royston, 2013). The director-general, Diane Lees, came on in 2008 and began "constructing a system that enabled staff ad departments to repurpose digitized objects for multiple outputs" (Maron, Yun, & Pickle, 2013, p. 40). IWM employees sorted Digital Asset Groups (DAGs) "by content type (film, curation, collection management, and digitation)" and developed workflows based on how the content interacted with departments (Maron, Yun, & Pickle, 2013).

By 2009, the initiative needed a dedicated position to "support the initiative" and develop "a comprehensive digital strategy that established mechanisms to support…. the digital sphere as an outreach tool." The new Head of Digital Media, Carloyn Royston, noted that the existing structure lacked a "coordinated approach or strategy to managing digital rights," and the challenge of finding the right approach required a fight against departmental silos (Royston, 2013). According to the lessons learned from the IWM staff, "centralization of the core infrastructure and production…created a common base" (Maron, Yun, & Pickle, 2013, p. 41). The IWM digital media team liaised between staff needs and strategic applications in this scenario. However, some areas needed input from "staff and departments outside the digital media team" (Maron, Yun, & Pickle, 2013, p. 41). The JISC research team reported that improving communication among cooperating archives and clarifying concerns mandated future projects include “champions” from multiple partner communities such as marketing, outreach, editing, IT, and more (Maron, Yun, & Pickle, 2013, p. 46).

A deep dive into the practices of the IWM may not directly correlate with the needs of the USAF archives. However, the research findings documented the benefits of creating an innovation team embedded within the AFHMP that can break through departmental silos and build strategic partnerships, ensure transparency during the development process, and effectively unify digital strategies and goals. The UK digital preservation guidance, recommendations, and IWM example offer the AFHMP a successful and sustainable infrastructure model to refer to while developing its plan to increase interoperability among DAF cooperating archives.

The Canadian Heritage Information Network **- Digital Policy and Planning**

In 1972 the Canadian Government approved the National Museum Policy, formerly establishing the country’s strategic vision for Canadian cultural heritage institutions

(Department of Canadian Heritage, 2022, p. 4). The guidance created the Canadian Conservation Institute (CCI) and the Canadian Heritage Information Network (CHIN). In 1995, these organizations reorganized under the newly established Department of Canadian Heritage, becoming Special Operating Agencies (SOA) under the larger Heritage Branch. Following the federal budget reduction in 2014, CCI and CHIN underwent an administrative merger and have been collocated since 2016. Despite the declining resource environment, the CCI and CHIN have "historically championed digital preservation as a core activity in museums by providing tools and training for digital asset surveys, digital preservation policy development and digital preservation planning and best practices" (Bieman, A Survey of OAIS Usage in Canadian Museums, 2021).

Today, the CCI and CHIN "advance the sustainable conservation of collections in Canada and expand Canadians' access to them while developing a professional environment" (Department of Canadian Heritage, 2022). While the two agencies share the same vision, each has unique missions and responsibilities within the federal organizational structure. According to the Director General of the Heritage Branch, Mr. Jerome Moisan, the merger of CCI and CHIN provides a synergistic environment that allows the federal government to offer "service delivery, research, and knowledge sharing" activities (Department of Canadian Heritage, 2022, pp. 3-5). CCI is the SOA responsible for providing expert services, advancing research into new heritage challenges, and sharing corporate knowledge through professional development opportunities (Moisan, 2022, p. 3). The CHIN builds on this corporate knowledge ensuring that Canadian museums have open access to the tools, training and guidance impacting "collections management systems, digitization, and digital preservation" (Moisan, 2022, p. 3). Much of the research and publications developed by the Heritage Branch are openly available in an electronic form to users with internet access. Therefore, the SOAs best practices, community

standards, and recommendations educate a wide range of heritage professionals in Canada and internationally.

One of the most utilized educational guidelines published by the Department of Canadian Heritage addresses the development process for digital preservation policies and plans within various cultural heritage institutions. In 2011, CHIN conducted a state of digital preservation survey to understand better the environment and constraints Canadian Museums experienced (Canadian Heritage Network, 2017). In response to the survey results, CHIN developed the Digital Preservation Toolkit to set a community standard for digital preservation policy and planning (Canadian Heritage Network, 2017). The toolkit applied "external standards, best practices, and recommendations [that] should be considered" from the international GLAM community to help the museum develop "digital policies, plans, and procedures" (Canadian Heritage Infomation Network, 2021). According to the resources published by CHIN,

> A digital preservation plan is a core document for any digital preservation activity. It contains an action plan describing actionable steps taken by an institution to preserve digital resources, and it documents how the action plan was chosen. Unlike a digital preservation policy, which provides high-level guidance, a digital preservation plan describes an actual workflow, and it [refers] to specific technology that will be used (Canadian Heritage Infomation Network, 2021).

The CHIN digital preservation toolkit developed a planning workflow targeting the seven benchmark attributes associated with a trusted digital repository (TDR) as outlined in the OAIS Reference Model (Canadian Heritage Infomation Network, 2017). This framework provides resources that assist IRs in assessing the current digital situation, considering the risk and

impact of losing access to those resources, and selecting the appropriate way forward (Canadian Heritage Network, 2017).

CHIN acknowledged that IRs with varying sizes experience similar obstacles but are not identical (Canadian Heritage Infomation Network, 2021). Therefore, CHIN offers alternate solutions for institutions of any size, offering practical ways to mitigate digital preservation issues and ensure the greatest degree of preservation, no matter the resource environment (Canadian Heritage Information Network, 2018). Consequently, the dynamics between CCI and CHIN, coupled with the framework published by the Department of Canadian Heritage, demonstrate how government agencies can leverage individual digital preservation policies, plans, and practices while ensuring a centralized standard of excellence. Ern Bieman, the Heritage Information Analyst for Canadian Heritage, stressed the importance of tailoring this framework since volunteer-run or single-employee organizations may not have the financial, labor, and skill sets necessary to create a complete OAIS-compliant model (Canadian Heritage Information Network, 2018). Even still, accessing open-source CHIN guidance offers AFHMP an opportunity to leverage the continuous use of pre-existing knowledge to improve DAF archives' decision-making and operational effectiveness.

The Present: Interview Findings and Case Studies

It is no longer enough for the Air Force History and Museum program to function only as repositories, preservationists, or content providers. AFHMP professionals must transition into laboratories within which military leaders can observe lessons from the past and the consequences of those ideas (Connecticut Historical Society, n.d., p. 2). In operational situations where Airmen cannot trust every digital source, operationalizing USAF archival data in the field and the lessons learned by past commanders can present a strategic advantage and trustworthy source of information. Equipping field history offices and archives with digital access to the global

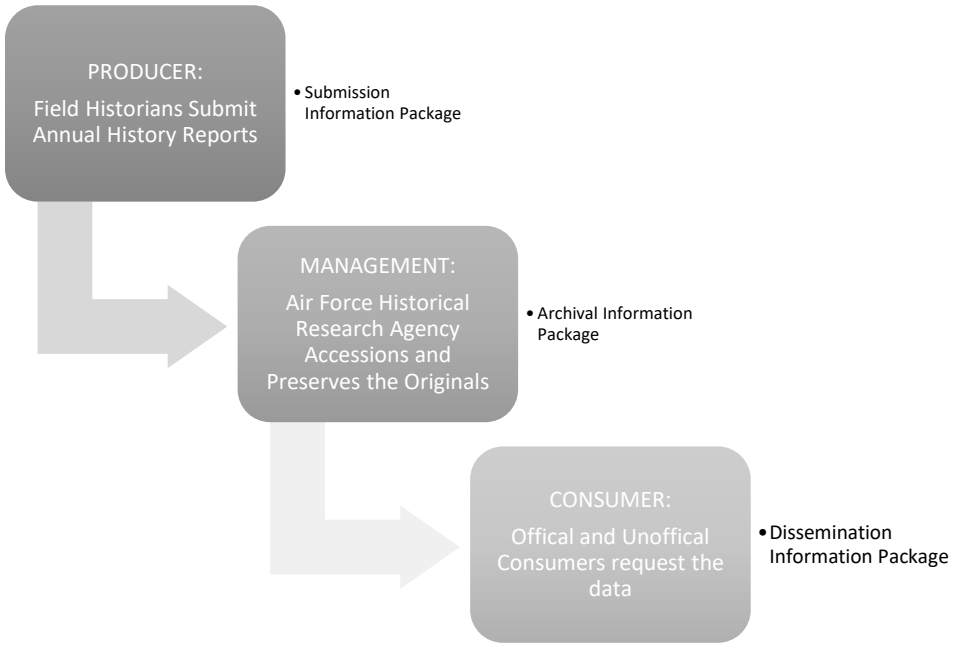
network of USAF repositories can help provide tomorrow's leaders with "the skills to understand whether a source is reliable, accurate, or biased; to decide which information is important; and, to think critically about and apply information in creative and productive pursuits" (Connecticut Historical Society, n.d., p. 2).

Throughout the interviews with DAF heritage professionals, it became clear that most did not fully understand how collaboration between institutions occurred in a digital operating environment. According to an unpublished study on the AFHMPs state of digital modernization, the Department of the Air Force's inability to move large, complicated data collections is the largest limiting factor. Capturing, storing, and delivering institutional data is labor-intensive, time-consuming, expensive, and often incomplete (AF/HO, 2021). History reports are burned to CD/DVD and mailed to AFHRA with a 2 to 6-year lag to archive resulting in loss of information, unresolved errors or missing data, and a lack of relevance to commanders and staff. In 2019, the Air Force History and Museums Program acknowledged that as "the system for recording and maintaining history and heritage [evolves] over time… the structure and needs of the developing service [change]" (AFHMP, 2019, p. 1). To understand how information is shared, this report section outlines the current DAF information packaging process, defines critical internal stakeholders from DAF designated community as outlined by OAIS, and reviews three case files covering user needs expressed by the four primary interviewees.

Defining an OAIS dynamics within the AFHMP

According to Mr. Timothy Brown, the Director of the Air Force Historical Research Agency, the nature of DAF holdings limits the stakeholders to those invested in the military community and United States military aviation history (Brown, personal communication, 2022). Regulations regarding the access to and use of records and information are pre-determined through governmental security classifications necessary to ensure national security (Witt,

personal communication, 2022). The general public does not have access to AFHMP digital holdings without supervision from a heritage professional (Michalke, personal communication, 2022). Archival materials at AFHRA are typically unpublished primary sources such as letters, messages, reports, studies, unit histories, and monographs. Usually, they hold information on significant military aviation history not preserved elsewhere. According to Mr. Michalke, common sources like books, magazines, journals, and other copyrighted and published materials generally found in libraries are typically not accessioned into DAF archives (Michalke, personal communication, October 31, 2022). Therefore, to fully understand the AFHMP's interoperability, one must examine the information packaging process through the lens of the OAIS standards.



AFHMP Producers

AFHRA depositors are limited to federal agency staff members responsible for collecting and retaining historical records for USAF and USSF memory. OAIS defines Producer as "the role played by those persons, or client systems, which provide the information to be preserved"

(CCSDS, 2012). US Air Force and Space Force Historians who collect, document, develop, maintain, and submit historical information packages for AFHRA stewardship function as the primary producers of digital assets. Each year these historians send annual history reports to the Air Force Historical Research Agency for long-term preservation (Witt, personal communication, 2022) (Newell, personal communication, 2022). These reports include "commander reports, narratives, orders, operations reports, digests, statistics, photographs, and miscellaneous items provided by the units." (Dysart, 2012, p. 1). As a result, AFHRA accessions "approximately 2,000,000 pages of historical material each year." (AFHRA, 2022).

According to Michalke, AMC Archivist, “Annual history reports cover a calendar year of historical data on a specific USAF/USSF unit and its subordinate elements (Michalke, personal communication, 2022). These reports function as OAIS SIPs for AFHRA. Typically, these official IPs are delivered by mail from the Producer to AFHRA on optical disks. Producers generating annual history reports receive minimal formalized training and follow the History Series of Air Force Instructions for official packaging guidance (USAF, 2022). This regulation equips the Producers through collecting, creating, and delivering SIPs to AFHRA for stewardship. However, this process only provides a general template for historical reporting and does not cover topics like metadata storage, time-based media preservation, or fixity checks.

AFHMP Managers

The Air Force Historical Research Agency operates as the primary United States Air Force (USAF) and Space Force (USSF) Institutional Repository tasked with preserving the US military's aviation-oriented textual, institutional memory (Airman Magazine, 2018). AFHRA serves as the central repository for the USAF official records dating from World War I to present operations (AFHRA, 2022). The Agency maintains "more than 70,000,000 pages" of collected documents and related materials. It even asserts that the repository acts as "the world's largest

and most valuable organized collection of documents concerning US military aviation." (Dysart, 2012). AFHRA staff members interact with the ingestion, processing, and preserving of born-digital and digitized records. Today, The Air Force Historical Research Agency continues this mission and has continually adapted to meet the needs of its changing collection. However, its content management system evolved organically over the years. Gilmore and Horton emphasized that " the AFHRA is embracing the digital age and just needs to continue to receive funding to stay on the right path" (Gilmore & Horton, personal communication, 2022).

AFHMP Consumers

` OAIS defines consumers as "those persons, or client systems, that interact with OAIS services to find and acquire preserved information of interest" (CCSDS, 2012). Coincidently, for AFHRA, the Producers are also the largest group of Consumers. AFHRA staff members disseminate the data by answering both official and unofficial requests. According to Ms. Maranda Gilmore, the Deputy Commander of AFHRA, "an official request would include ones from other government organizations, Congressional, VA requests, or other official agency. An example of an unofficial request would be from a non-US government affiliated person or group for copies of historical records" (Gilmore & Horton, personal communication, 2022).

USAF heritage professionals each maintain a level of access that is uniquely restricted. These professionals cannot request or access digital documents outside the security group profile tailored to that individual's interest (i.e., historians can only request information about their assigned unit and its ascendants). A USAF consumer requesting copies of previous annual history reports for their designated organization is restricted by the Selective Dissemination of Information (SDI) protocol (Michalke, personal communication, 2022). These individuals must still have the appropriate security clearance to access historical information. According to Witt, title, consumers can't access data above their clearance level or data that does not warrant a

"need to know" (Witt, personal communication, 2022). Therefore, developing cyberinfrastructure to support this security environment will require the service provider to demonstrate that it can mitigate these challenges.

Summary of Environment and Constraints

"A research infrastructure encompasses both technology and process. As technology, it is a collection of computer hardware, software, and networks designed and operated to support research activities. As a process, it implements and enforces policies, conventions, and rules to ensure that the technology is applied in ways that meet user needs in such areas as security and trust" (Foster, 2018, p. 103). For tomorrow's commanders to make informed decisions, USAF historians and archivist must utilize a research infrastructure capable of linking "highly sensitive data from multiple sources" (Foster, 2018, pp. 103 - 104).

The Major Command (MAJCOM) and Field history offices maintain a copy of wing and numbered air force unit annual history reports from their chain of command and organizational files specific to their organizations. Typically, the smallest IRs are associated with a wing or a delta and will have approximately sixty or more linear feet of paper files, 12-60 rolls of microfilm, and 2-5 terabytes of digital data (Grudzinskas, 2016). Preservation copies of annual history reports are kept by the field office and MAJCOM, with the originals being shipped to AFHRA for long-term preservation. Some, but not all, MAJCOMS employ an archivist to manage and preserve digital and analog data for their combined repositories. Historians can search retained files in a unit history repository on hard drives and shared drives using keyword searches in the file structure. Information is not shared or disseminated.

The next step of this research outlines the challenges associated with "accelerating change" in the lifecycle management of digital assets. DAF leaders from three different commands were asked about the limiting factors impacting their ability to operationalize digital archives. The answers ranged from a lack of educational training, the unknown implications of adopting digital enclaves, and service-wide technology issues. The following three case studies outline the challenges each subject matter expert described.

Case Study A: AMC Archives– Archival Silos with Minimal Training Options

Air Mobility Command History Office (AMC/HO) is one of eleven USAF Major Command (MAJCOM) History Offices. AMC/HO operates out of Scott Air Force Base, Illinois. The program establishes policy and oversees 18 subordinate wing history offices, the Air Force Expeditionary Center, the 618th Air Operations Center, and the 18th Air Force. The historians in the office routinely publish special studies, case files, vignettes, and fact sheets on history and heritage related to Air Mobility Command's lineage, honors, and operational legacy. According to former-deputy commander Mr. John Murphy, AMC/HO also facilitates the deployment of field historians in support of global contingency and humanitarian operations (J. Murphy, personal communication, 2022). The AMC historians rely on their archival collection to "advise commanders and leaders based on a repository of information that covers missions, personnel, aircraft, basing issues, diplomacy issues, threats, and lessons learned" (Ames, 2016). Providing perspective using archived historical data ensures commanders make informed decisions and anticipate third-order impacts before responding to a situation. The primary caretaker for the AMC archive is Mr. Jeff Michalke. Michalke manages the archives, airparks, and artwork associated with AMC's history and heritage. His insight into the DAF archival community highlighted how severely the DAF neglects the Archivist role and professional development.

During Michalke's s interview, he expressed the desire for a sustainable archival model capable of increasing the interoperability of DAF IRs and a digital preservation management process that offered template-like features to assist producers with information submission. Even still, this process must be cost-effective, requiring minimal additional training since all the interviewees described limiting factors related to funding and staffing. Michalke noted that the program archivists had expressed interest in learning more about digital curation, digitization, and tools to improve their craft (Michalke, personnel communication, 2022). However, several rely on younger heritage professionals to identify and explain the new tools and techniques rather than seek the information independently (Michalke, personal communication, 2022). The reliance on younger heritage professionals generates cause for concern. The decision to transition into a civilian workforce significantly impacted AFHMP's capacity to hire younger generations of heritage professionals since DoD policy regulates civilian hiring practices and mandates priority placements (Brown, personnel communication, 2019).

Furthermore, suppose data within the field and MAJCOM-level IRs is missing or found to be corrupted. In that case, the DAF archivist must contact the Air Force Historical Research Agency at Maxwell Air Force Base to obtain preservation copies of the information necessary to answer historical inquiries. Ultimately, this increases the turnaround time on inquiry response and leaves field offices reliant on AFHMP personnel to search, retrieve, and disseminate information. If the consumer cannot articulate their request well enough to AFHRA, the data may not be discoverable or incorrect data may be sent (Michalke, personnel communication, 2022). There are not officially approved finding aids or catalogs provided to or accessible by field archivists or historians (Schroeder, personnel communication, 2019). The only software capable of retrieving or reviewing record copies is maintained in-house at AFHRA. There is no digitally accessible solution for MAJCOM and subordinate History Offices without the time, money, or staff to send to Alabama. Thus, forcing the success of these History Office's research,

interpretation, and dissemination activities to be reliant on the already overworked AFHRA staff. During a follow-up with Ms. Maranda Gilmore on this dynamic, she mentioned that there are currently no plans to change this as all "digital information that is part of AFHRA's collection is managed in-house for now and the foreseeable future" (Gilmore, personal communication, 2022).

Recent financial and personnel cuts across the AFHMP also impacted the archivist's ability to develop professionally and network with others in the career field (Michalke, personnel communication, 2022). Several utilize the Microsoft Teams platform to ask questions and share information, resources, and tool (Michalke, personnel communication, 2022). However, this practice is very ad hoc and not universally employed. Even still, Michalke asserted that there is currently no archivist training course offered when onboarding into the program, unlike the routinely offered Historian Training Course (Michalke, personnel communication, 2022). The resulting environment leaves DAF archivists departmentally siloed with minimal room for professional development.

Case Study B: AFSOC History Office - Security of Data in the Cloud

Trevor Owens, head of digital content at the Library of Congress, elaborated on the levels of access and restriction necessary during digital curation. Owens stated that "there are increasingly sophisticated ways to provide useful access to aspects of a collection while still respecting the restrictions to access that emerge from copyright, privacy, and cultural norms" (Owens, 2018, p. 168). A prime example of the need for multimodal levels within the DAF archives is the Air Force Special Operations Command History Office (AFSOC/HO), located at Hurlburt Field, Florida. AFSOC/HO operates within the most restrictive digital environments with real-life consequences should the archival data be mishandled. Air Force Special Operators function at the tip of the spear and heavily participate in what DAF commanders describe as the "high-end fight" (Brown, CSAF Action Orders: To Accelerate Change Across the Air Force,

2020). The AFSOC mission mandates that the historical data generated by this command often include sensitive data. According to Mr. Witt, sensitive data includes information on current military units, modern weapons, tactics, techniques, or training principles that could put soldiers at risk if the information is accessible by American enemies (Witt, personal communication, 2022).

In addition, AFSOC history data and archive sources also cater to the joint-military community of special operators (i.e., other Department of Defense agencies). Interoperability with other DoD agencies and the entire DAF is of the utmost importance. However, the security and safety of digital data are of more significant concern. The AFSOC archive is functionally a dark archive, where actual files are preserved but inaccessible to several stakeholder communities (Witt, personal communication, 2022). During the research process, the Director of the Air Force Special Operation Command and members of the AFSOC/HO team provided information on how its designated community accesses and employs the archival holdings. However, it is almost impossible for anyone outside the Historian employees to view the collections without the appropriate security clearances and “a need to know” (AFSOC/HO team, personal communication, 2021). The AFSOC History Office does not maintain an archivist on staff. Thus many of the roles and responsibilities of an archivist fall on the MAJCOM and subordinate unit historians (Witt, personal communication, 2022). The team answers inquiries from Congress, the White House, other federal agencies and departments, internal Air Force and Space Force sources, and the American public without any of the training associated with Mr. Witt, dubbed “a degree in data processing” (Witt, personal communication, 2022). According to him, any future digital curation environment must consider that several History Offices are run entirely by historians. Since “we're historians, we are not supposed to be doing that [archival] stuff” (Witt, personal communication, 2022).

For the AFSOC/HO team, a digital infrastructure with tools that facilitates quick identification of potentially relevant content on a computer is the goal (AFSOC/HO, personal communication, 2021). However, developing a research infrastructure that ensures safe access to classified information is a user need (Witt, personal communication, 2022). According to senior scientist and distinguished fellow at Argonne National Laboratory, Ian Foster, "these efforts are often hindered by legal, technical, and operational difficulties" (Foster, 2018, p. 102). Three commonly accepted control mechanisms within scientific data infrastructures warrant further investigation by the Air Force History and Museum Program, the Curator Model, Secure Enclaves, and Cloud-based enclaves.

According to Foster, the Curator Model "limits the data that analysts can access, the operations that they can perform on data, and the results that can be obtained from analysis, to prevent them from ever seeing sensitive data" (Foster, 2018, p. 108). The most known employer of this model is the US Census Bureau. Information collected during a census holds sensitive information, and US Census Curators aggregate the data and suppress specific elements "in a way that does not compromise the privacy of the individual respondents" (Foster, 2018, p. 109). Based on the conversations with the AFSOC/HO team, this method would not be a practical approach for the USAF. The Curator Model would not be suitable because "removing personal identifiers completely or replacing each identifier in the data set with a unique key" would undermine the historical integrity of the data (Michalke, personal communication, 2022) (Foster, 2018, p. 109).

In contrast, "Secure Enclaves…allow full access to the data but then restrict who is allowed that access and what data can be exported" (Foster, 2018, p. 108). This form of data control better aligns with existing national security processes and the cyber requirements at AFSOC (Witt, personal communication, 2022). However, the variants of secure enclaves present

unique weaknesses. Air-gapped enclaves “are frequently employed by national security organizations” where “analysis must be performed in a secure enclave with no Internet connection” (Foster, 2018, p. 109). Despite being the most accepted secure data infrastructure for the Air Force, Foster argues that “air-gapped enclaves are inconvenient, costly, and lack support for importing data from other sources” (Foster, 2018, pp. 109 -110). The issues associated with the physical requirements of air-gapped enclaves led to the development of Secure Remote Access. The new system allowed analysts to access secured enclaves remotely “via secure authentication” (Foster, 2018, p. 110). However, the inherent risks associated with remote access included a lack of “control over the secure analyst’s computer environment,” and it still did not “directly address the need for analysts to integrate data from multiple sources” (Foster, 2018, p. 110).

The third option for US military historical data is cloud computing. Director Witt mentioned several reservations about digital preservation in a cloud environment (Witt, personal communication, 2022). In 2013, the US government developed a certification process called “the Federal Risk and Authorization Management Program (FedRAMP). FedRAMP functioned as an audit method capable of determining whether a particular combination of cloud provider and user software and procedures [could] be used for sensitive data from federal agencies” (Foster, 2018, p. 112).

FedRamp accredited infrastructures (IaaS), platform services (PaaS), or software-as-service (SaaS) offer a “secure, scalable, and virtual” alternative for the Air Force History and Museum Program’s digital archives (Foster, 2018, p. 112). However, ensuring that archival service providers are FedRAMP-accredited with a certification process for protecting the data is increasingly difficult. Other accreditation methods are available from the civilian GLAM community, but futher research is needed to ensure legal applicability. Therefore, future

research must focus on determining cloud enclaves' legal, technical, and operational suitability within the AFHMP.

Case Study C: AFHRA – Tools and Techniques

The Air Force Historical Research Agency (AFHRA) manages the official copy of all DAF history files at Maxwell AFB, Alabama. As the primary IR for the Department of the Air Force, AFHRA maintains the complete and official copy of all organizational history files for active and inactive units. History reports and other information are accessioned from CD/DVD and saved to “on-premises” servers utilizing IRIS II, an Air Force proprietary inventory/card catalog search and retrieval software system. Metadata tags, distinct catalog numbers, and call numbers are added, administrative data and classification markings are manually entered, and a microfilm copy of all textual material is made directly from the digital version (Gilmore & Horton, personal communication, 2022). Ms. Maranda Gilmore, the deputy director of AFHRA, and Mr. Christopher Horton, the Team Lead for Information Technology, spoke on the current state of archival readiness. “Steps to develop digital curations policies have already been taken given that AFHRA has been accessioning electronic unit histories since 2003,” stated Ms. Gilmore. The Accessions Division handles all incoming digital records first. Once the records are indexed, they are incorporated into the collection for research (Gilmore & Horton, personnel communication, 2022).

Gilmore noted that when operating in-house, “the Research Team would utilize the records the most, other sections such as Organizational History uses them as well” (Gilmore, personal communication, 2022). However, “organizational history uses records, such as the lineage and honors and emblem files that other sections would not use as often” (Gilmore, personal communication, 2022). AFHRA is taking steps to provide increased access to more

data through digitization efforts and an online website. However, sustaining these initiatives in a declining resource environment proves difficult (Gilmore, personal communication, 2022).

The most significant point of contention in AFHMP cyberinfrastructure is the adoption of the Knowvation software. Knowvation is a commercial off-the-shelf (COTS) software for content management, and there is no in-house software development by AFHRA. AFHRA began digitizing paper files in 2003 (Gilmore & Horton, personal communication, 2022). Since then, personnel cuts and funding lapses have slowed the process. AF/HO is exploring a more cost-effective method using the Defense Logistics Agency (Brown, personal communication, 2022). In 2022, the Air Force committed to funding annual software maintenance for Knowvation (Brown, personal communication, 2022). The service agreement mandates that Knowvation provide updates as needed based on the requirements of the AFHRA and its users (Gilmore & Horton, 2022). AFHRA's IT team then pushes these updates to the system (Horton, personal communication, 2022).

It is important to note that DAF's support of the purchase of this software did not actively involve heritage professional input from the larger Air Force History and Museum Program. Leaders from several Major Commands are skeptical of its effectiveness and suitability for their collections (Witt, personal communication, 2022) (Newell, personal communication, 2022) (Michalke, personal communication, 2022). As mentioned, AFHRA currently restricts all Knowvation technology access to in-house personnel (Gilmore & Horton, 2022). A primary cause for concern is that "AFHRA does not have specific DAGs. All digital files are put into the Knowvation system. Each record is accessioned and identified by type within the metadata, such as periodic histories, oral histories, and personal collections“ (Gilmore & Horton, 2022). Even still, “newer files ingested into the systems are named by the field or [Major Command (MAJCOM)] historian” (Gilmore & Horton, 2022).

According to Ms. Gilmore, the most critical aspect of digital preservation service is that data is appropriately marked for ease of indexing and retrieval. At AFHRA, born-digital assets follow the same chain of custody as paper and microform documents. They are entered into the master log in AFHRA's Accessions Division and then indexed into the IRIS (Knowvation) System. Ensuring this data can be discoverable post-accessioning requires a complex network of controlled vocabularies, thesauri, and metadata schemas (Owens, 2018, pp. 131-132). Therefore, for machines to effectively read the data stored within a Content Services Platform (CSP) and retrieve relevant results, the entirety of the data – "all the file formats, encoding standards, operating systems, rendering applications– need to interlock to enable various way to interact with and make sense of that information" (Owens, 2018, pp. 70-71).

The data profiles included in the first appendix of this report prove that every USAF archive implements unique digital preservation practices that decrease Knowvation retrieval capabilities and impact cooperating DAF archives. Discrepancies with metadata, naming conventions, and file formats document that AFHMP professionals have not universally interpreted the History Series Air Force Instructions similarly. Relying on field historians to interpret the guidance of file naming and not correcting discrepancies as they are ingested into the CSP pose a threat to future retrieval capability. Unless the history program intervenes by generating a digital preservation policy and plan, future digital service platforms will not be useful to the producers, managers, or consumers.

The Future: Findings and Recommendations

Goals

"It is the role of historical organizations to develop abilities, spur debate, and inspire solutions. These institutions must be the dynamic agents of democracy that seek to develop an active, educated, and engaged citizenry" (Connecticut Historical Society, n.d., p. 2). This report

demonstrates that the Air Force History and Museum Program is postured to embrace the digital age. However, the evidence establishes that a lack of official training on digital asset management, Air Force support, and governmental funding present significant obstacles to success. To accelerate the change necessary to achieve the digital curation goals of the AFHMP, the DAF must define an appropriate course of action. For many DAF heritage personnel, this includes the “sustainment of funding for Knowvation, migration to a cloud platform, trained professionals, and technology support” (Brown, Gilmore, Horton, personal communication, 2022).

As the Air Force Historical Research Agency restructures its archive to embrace Air Force and Space Force history, there is no better time to accelerate change that ensures archival accessibility and usability "to all Air Force, military, and other Federal Government activities, the public in general, to the extent they are entitled to them" (Dysart, 2012, pp. 17 - 18). In the words of General Charles Q. Brown Jr, to accelerate change within the program, "the USAF must work differently with other Department of Defense stakeholders, Congress, and traditional and emerging industry partners to streamline processes and incentivize intelligent risk-taking in support of the warfighter and the Nation" (Brown C. Q., Accelerate Change or Lose, 2020, p. 5). According to the Air Force History and Museums Program interviewees, candid conversations are the next step to address the lack of digital curation and deliberate development across the force. Now is the time to ruthlessly examine current practices, reflect on the past lesson learned, and rapidly change the information packaging process.

Realities

Eliot Wilczek, the acting director of Tufts University’s Digital Collections and Archives, and Heather Soyka, a doctoral candidate in archival, suggested that to curate official military records, “archivists and records managers must grapple with the immense volume and

complexity of these records. Part of the challenge of documenting [modern warfare] has been overcoming the difficulties in systemically creating, managing, and protecting operational records in-theater and safely transferring them to preservation environments" (Soyka & Wilczek, 2014, pp. 190-191). Despite these challenges, continued research examining the correct digital curation model and framework appropriate for the Air Force History and Museums Program is warranted. The work thus far is promising, but further interoperability among DAF heritage professionals offers new ways to foster resiliency within the program and the DAF.

It is important to note that current international archival models express in multiple ways that there is no such thing as an enterprise-wide solution. To effectively operationalize the USAF Digital Archives and ensure appropriate standards and governance, AFHRA leadership must innovate from within (Albon, Hyten Calls for Innovation, Culture Change In USAF Space and Cyber, 2012). An embedded innovation cell at AFHRA can generate, test, and facilitate future policies and plans to select the right tools for each function. The team should be a cross-command and interdepartmental team of professionals to include representation and navigate concerns from the entire DAF GLAM community. In addition, the program should invite consultants from Cyber Command, Air University, NARA, and civilian digital preservation services (Schmidt, et al., Commercial Practices Might Aid USAF, 2015).

With the impending responsibility of long-term preservation of Space Force memory, AFHRA must act swiftly to develop formally approved vocabularies and thesauri for Space Force histories, airframes, and institutional memory before the collection is too far along to fix. Furthermore, retrieval software is only effective when IRs uniformly centralized and digital strategies are standardized. No 'holy-grail' software will meet the needs of every DAF community, and there is no way to ensure every user is happy with the workflow. Therefore, the policy, planning, and programs must facilitate a tailored approach to long-term preservation.

The DAF will likely never be able to backdate a controlled vocabulary into their system, but they could implement a standard lexicon and list of acceptable keywords moving forward. Knowvation can be an instrumental CSP if AFHRA develops the platform with input from staff and MAJCOMs across the AFHMP. Based on this information, the following actions are recommended:

1. Organize: Develop a Digital Preservation Innovation Cell to develop and test policies, plans, and programs. Routinely disseminate their finding to the workforce.
2. Train: Facilitate and fund professional development opportunities that ensure heritage professionals can access the appropriate training and tools
3. Equip: Establish a digital infrastructure for DAF cooperating archives that provide services, recommendations, and community standards while ensuring future DAF heritage professionals can audit the system and demonstrate critical attributes.

Sustaining a Digital Legacy: Final Thoughts and Way Forward

Today's AFHMP leaders must accelerate change and develop a cyber innovation solution to meet its mission. If current practices continue, the Air Force risks a decline in the relevance of worldwide field history offices and limits its future military leader's ability to make informed decisions in the heat of battle. The subject matter experts interviewed during this research provide input on improving the existing infrastructure. This research uncovered a few ways the Air Force History and Museums Program should innovate to operationalize its IRs. Today's AFHMP leaders must accelerate change and develop a digital information infrastructure that can be operationalized during cyber and physical warfare. If current practices continue, the Air Force risks a decline in the relevance of worldwide field history offices and limits its future military leader's ability to make informed decisions in the heat of battle. The subject matter experts interviewed during this research provide input on improving the existing infrastructure.

The interviews uncovered a few ways the Air Force History and Museums Program should innovate to operationalize its IRs.

For tomorrow's commanders to make informed decisions, field historians, archivists, and museum staff must have a research infrastructure capable of linking "data from multiple sources" (Scanlin, personal communication, 2022). If the AFHMP implemented a policy where it became the go-to place for the best Air Force history data, even better than a simple Google search, its stock in the defense sector would go up. Eventually, future leaders would see the strategic value of supporting and funding the Air Force History and Museums Program as a valuable weapons system. The situation will only worsen until field museums are empowered with the staff, training, funding, and authority to manage their unique digital collections. Ultimately, the ones most impacted by the AFHMP's inability to embrace the digital age will be the veterans and military families of the future because there will be no retrievable data when it is time for them to start looking for it (Scanlin, personal communication, 2022).

This report presented qualitative evidence that reveals the Air Force History and Museum Program must adapt to meet the needs of the next generation of Airmen. It found that field historians, archivists, and senior leadership do not have a baseline understanding of the critical components of digital preservation. The USAF program built a distinguished and trustworthy process for the long-term preservation of analog files, but it is failing the future digital consumer with the current reporting process. To continue being a trustworthy government repository, AFHMP and USAF leaders can no longer ignore that the future fight will require Airmen to maintain easy digital access to critical historical records.

The dissemination of information and who handles the responsibility of innovating those practices are pressing arguments that must be addressed. The Air Force’s Chief of Staff directed DAF agencies to “identify systems and programs that are outdated and unaffordable to make

way for new capabilities that will make [them] competitive in the high-end fight" (Brown, Accelerate Change or Lose, 2020). The current situation with DAF archives is both outdated and unaffordable. Allowing Air Force archives, especially AFHRA, to operate as a collection point for AIPs without the intent to disseminate or grant access to the rest of the history program interrupts the digital curation lifecycle. Even still, it directly impacts historians' and archivists' ability to answer research inquiries with full context, insight, and analysis capabilities. The Air Force History and Museum program must adapt to the future information-reliant environment and ensure the digital infrastructure facilitates quick and easy access to relevant data.

The next generation of USAF heritage professionals will compete for trustworthiness against Google, Wikipedia, social media, and other cyber information platforms. To ensure future Air Force leaders can access an unbiased and trustworthy historical narrative, today's heritage professionals must fight to build a cyberinfrastructure that rivals these platforms. Moving forward, Air Force History and Museum Program leaders and digital innovators must ask themselves: As military combat accelerates into the fifth dimension, cyber warfare, are USAF heritage personnel organized, trained, and equipped to meet their mission in a digital realm?

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Appendix A – Data Curation Profiles

a. Air Force Historical Research Agency Data Curation Profile
b. Air Mobility Command Data Curation Profile
c. Air Force Special Operation Command Data Curation Profile

Author's note: The following data curation profile questions utilized during each interview derived from recommended standards outlined in:

Carlson, J. (2010). The Data Curation Profiles Toolkit: Interview worksheet. Purdue University. Retrieved September 20, 2022, from https://docs.lib.purdue.edu/cgi/viewcontent.cgi?article=1002&context=dcptoolkit

CHIN. (2017, October 4). Digital preservation inventory template for cultural heritage institutions. Government of Canada. Retrieved September 25, 2022, from https://www.canada.ca/en/heritage-information-network/services/digital-preservation/inventory-template-museums.html#a2

Data Curation Profile for Air Force Historical Research Agency

Data Collected from: Ms. Maranda Gilmore, Research and Mr. Chris Horton

Archival Collection Information

1. **Digital Asset Groups (DAG):** Using the chart provided, please identify the primary DAGs held by your organization. If the exact numbers are unknown or cannot be given, please provide a rough estimate or state N/A.

Name of Digital Asset Group (DAG)	**Brief Description of Group (i.e., what tangible collection the digital data correlate with, file formats within the group, etc.)**	**Approximate Number of Digital Assets in Group**	**Approximate file space required to store group (please include the unit of measurement – kb, MB, GB, etc.)**	**The minimum number of copies maintained by the organization**	**Where did the files originate?**
AFHRA does not have specific DAGs. All digital files are put into the Knowvation system. Each record is accessioned and identified by type within the metadata, such as periodic histories, oral histories, personal collections, etc.					

2. **File Naming:** Please identify how file names are constructed for DAGs (is there a standard naming convention used throughout AFHMP).

   Newer files ingested into the systems are named by the field or MAJCOM historian.

3. **Accessibility:**

   a. **Location:** Where are the digital files stored while being accessioned into the museum's collection (i.e., SharePoint, shared drive, website, etc.)?

Digital files are stored on the servers and are accessed using the Knowvation software application

b. Where does the data go after accessioning?

Data will go to the Knowvation application after accessioning and loaded onto the server.

c. Identify the location(s) and environmental conditions at which the DAGs are preserved (check all that apply): **See question 1.**

d. Is the information backed up in a data repository?

YES

If you answered "yes," please identify the associated repositories. (i.e., Flickr, DVIDS, etc.)

Server backups are done using CommVault backup software.

4. **Security Protocol:** Please indicate any access restrictions regarding each DAG:

Name of DAG	Can the DAG be displayed in an exhibition	Does it need a trigger warning (if so, why)	Is it only viewable to those with a need to know	Can it be published online	What is the overall security classification for the DAG (i.e., unclassified, CUI, Secret, etc.)
All Knowvation access is currently restricted to AFHRA personnel only.					

5. **Releasability & Justification:** For the classified DAGs, please indicate the approximate declassification date. If information is unreleasable, please indicate why (i.e., an audio recording of the Airmen or Guardian's final moments un-releasable of our respect for family, a photograph showing a graphic combat casualty, etc.) **Not applicable.**

a. For data marked un-releasable, please specify why the archive decided to continue preserving the data. **AFHRA holds both classified and unclassified historical documents that are preserved for research purposes.**

6. **Freedom of Information Act (FOIA):** Are there any collections that require a formal FOIA request or mandatory declassification review before release? If so, which ones? **Yes. Any classified or restricted document requested by a person without a clearance and need to know has to either go through the FOIA or MDR process.**

7. **Collection Needs:**

   a. **Physical security:** what security measures are in place to protect digital assets? **All physical and digital records are stored within AFHRA which is a secure area with restricted access.**

   b. What tools – software or hardware – are used in generating the data? **Data such as the electronic unit histories are generated in the field and at the MAJCOM history offices using their own equipment. The histories are uploaded to the VAULT and then downloaded by AFHRA staff.**

   c. What tools – software or hardware – are used to understand the data? (i.e., Microsoft Office, ViSTA Virtual Reality Toolkit, Auto CAD, etc.) **AFHRA uses PTFS Knowvation software**

8. **Usability:**

   a. **Target Audience:** Whom would you imagine this data's primary consumer? (military researchers, installation command team, veterans, reserve, active-duty soldiers, etc.) **AFHRA is open to the public and has a varied customer base.**

We have research requests from all of the above in addition to providing support to Air University faculty and students.

b. How do you anticipate the data will be employed by the target audience listed above? **AU students use the information to complete course work, while others are generally completing research projects, or inquiring about a family member's time in service. AFHRA also processes FOIA requests, answers Whitehouse and Congressional requests, and a variety of other official requests.**

c. What are the most critical parts of the data to preserve for your target audience (manage and maintain over time)? **I believe the most important pieces of our collection are the unit histories. Although we hold other significant collections, such as personal paper collections, the unit histories are vital to meet AFHRA's mission.**

Data Curation Profile for Air Mobility Command History Office

Data Collected from: Mr. Jeffrey Michalke, Command Archivist

Archival Collection Information

9. **Digital Asset Groups (DAG):** Using the chart provided, please identify the primary DAGs held by your organization. If the exact numbers are unknown or cannot be given, please provide a rough estimate or state N/A.

Name of Digital Asset Group (DAG)	**Brief Description of Group (i.e., what tangible collection the digital data correlate with, file formats within the group, etc.)**	**Approximate Number of Digital Assets in Group**	**Approximate file space required to store group (please include the unit of measurement – kb, MB, GB, etc.)**	**The minimum number of copies maintained by the organization**	**Where did the files originate?**
Air Force Organizational Records	All material in AMC/HO archives are not official AF records, only ref and research. Official records maintained at the AFHRA.	N/A	N/A	N/A	N/A
Annual History Reports (AHP)	AHPs prior to 2003 were hard copies. After 2003, became	13,487 files	11.324GB	1 original (HDD) and 2 back-ups (1xOptical media, 1xExt	Files originate with HQ AMC directorates and

	digital. File types include DOCX, PPTX, XLSX, PDF, JPG and MP3.			HDD) per report.	subordinate units.
Historical Photography	Various photos from 1940s-1990s	3,753	6.92GB	1xExt HDD and 1xAF Network BUP	Various AF, Army, and govt sources
Reference and Research Material	Studies, monographs, statistics, memos, plans, etc.	12,171 files	26.2GB	1xExt HDD and 1xAF Network BUP	Various sources within AF

10. **File Naming:** Please identify how file names are constructed for DAGs (is there a standard naming convention used throughout AFHMP).

    AFHMP does not have a set naming convention for reference and research material.

    For Air Force History Reports, files are named in the following manner:

    Sup Doc # | yyyymmdd | (classification and admin control marking) | Type | Office of Origin | and 60-character max description

    EXAMPLES:

    2845_20190418_(U)_Email_AF-HO_File_Naming_Guidance.pdf

    3400_20191231_(CUI-PII)_Brfg_123FW-HO_Diginified Transfer.pdf

11. **Accessibility:**

    a. **Location:** Where are the digital files stored while being accessioned into the archive's collection (i.e., SharePoint, shared drive, website, etc.)?

       Unclassified digital files for the annual history are stored on the unclassified network shared drive and then transferred, via optical media, to the

classified network for finalization. Reference and research files are stored in the appropriate directory on the network shared drive.

b. Where does the data go after accessioning?

The accessioned data is maintained on the network shared drive in the appropriate digital folder.

c. Identify the location(s) and environmental conditions at which the DAGs are preserved (check all that apply):

	Regular Office environment	**Specialized Environment (please elaborate)**	**Warehouse/Other**	**Condition Unknown**	**Do you believe the DAGs stored here are at risk?**
Network server room (for shared drives or Web server space controlled by AF)	Unknown	Unknown	Unknown		Unknown, subject to AF Comm guidance.
Storage Vault or Archive Room	AMC History Office is a secured vault with an intrusion detection security system.	AMC/HO does not have a dedicated HVAC system; temps/humidity subject to set bldg. standards	N/A	N/A	Archives have fire suppression system and located above ground level. Risks include fire/water damage and tornadoes.
Regular office space	N/A	N/A	N/A	N/A	N/A

Off-site storage (record center, cloud space)	Unknown	Unknown	Unknown	N/A	Unknown, subject to AF Comm guidance.

d. Is the information backed up in a data repository?

YES / NO / **UNSURE**

12. **Security Protocol:** Please indicate any access restrictions regarding each DAG:

Name of DAG	**Can the DAG be displayed in a museum exhibition**	**Does it need a trigger warning (if so, why)**	**Is it only viewable to those with a need to know**	**Can it be published online**	**What is the overall security classification for the DAG (i.e., unclassified, CUI, Secret, etc.)**
Air Force Organizational Records	No	Unknown	Yes	No	Unclassified, CUI and Secret
Ref and Research	Only unclass info	Unknown	Yes	Some items (books, background papers, etc.)	Secret, Unclass and CUI

13. **Releasability & Justification:** For the classified DAGs, please indicate the approximate declassification date. If information is unreleasable, please indicate why (i.e., an audio recording of the Airmen or Guardian's final moments un-releasable of our respect for family, a photograph showing a graphic combat casualty, etc.)

Classification dates vary dependent upon information. Information may not be releasable if military unit/weapons status, tactics, techniques, or training principles are identified.

a. For data marked un-releasable, please specify why the Air Force decided to continue preserving the data.

Data is preserved to assist leaders in future military decision making.

14. **Freedom of Information Act (FOIA):** Are there any collections that require a formal FOIA request or mandatory declassification review before release? If so, which ones?

    Annual histories require a formal FOIA request and/or a Mandatory Declassification Review (MDR). Once classification status is determined, reviews by Public Affairs and Staff Judge Advocate are required to make final determination regarding public release. Information may not be released if it identifies current tactics, training, or techniques utilized by Air Force units. Controlled Unclassified Information (CUI) is reviewed by Public Affairs to ensure Personal Identifiable Information (PII) is not released.

15. **Collection Needs:**

    a. **Physical security:** what security measures are in place to protect digital assets?

       The AMC History Office is located on an Air Force Base with controlled access and located within a facility with access controlled via electronic cipher lock. Within the secured facility, the AMC History Office is in a vault secured with an Intrusion Detection Alarm System, an XO-10 combination lock, and an electronic door lock which controls access via Common Access Card (CAC). The data residing on the network is protected by AF and DoD computer security protocols.

    b. What tools – software or hardware – are used in generating the data?

       Data is generated via the AF Standardized Desktop software (MS Office, Adobe Acrobat Pro)

c. What tools – software or hardware – are used to understand the data?

MS Office and Adobe Acrobat Pro

16. **Usability:**

a. **Target Audience:** Whom would you imagine this data's primary consumer? (military researchers, installation command team, veterans, reserve, active-duty soldiers, etc.)

The target audience for the AMC History Office archives include AMC leadership, AF organizations, external audiences to include members of Congress, researchers, veterans, and the general public.

b. How do you anticipate the data will be employed by the target audience listed above?

Information can be utilized in various ways to include AMC leadership for future decision making to the general public desiring to learn about AMC history and heritage.

c. What are the most critical parts of the data to preserve for your target audience (manage and maintain over time)?

Accessibility to the digital information and data integrity. If the files become corrupt, and no back-ups are available, information may be forever lost.

d. Is there anything else the interviewer should know about the data you preserve?

The Air Force History and Museums Program (AFHMP) requires all history offices to produce unit electronic histories and maintain copies on optical media. However, the AFHMP does not a have a mechanism to verify optical data integrity/accessibility other than opening EVERY file on the disc. The

only time the historian will know if the disc is corrupted is when trying to conduct research, at which time it may be too late to try and save the data.

Data Curation Profile for Air Force Special Operation Command History Office

Data collected from: Mr. Eric Witt, AFSOC Command Historian and the AFSOC History Office.

Archival Collection Information

1. **Digital Asset Groups (DAG):** Using the chart provided, please identify the primary DAGs held by your organization. If the exact numbers are unknown or cannot be given, please provide a rough estimate or state N/A.
    a. **This is a depiction of our collections on the unclassified network. All official histories on classified network amount to 4,054 files and an additional 123 GB's of information that may or may not be mirrored on the unclassified network.**

Name of Digital Asset Group (DAG)	**Brief Description of Group (i.e., what tangible collection the digital data correlate with, file formats within the group, etc.)**	**Approximate Number of Digital Assets in Group**	**Approximate file space required to store group (please include the unit of measurement – kb, MB, GB, etc.)**	**The minimum number of copies maintained by the organization**	**Where did the files originate?**
Air Force Organizational Records	AFSOC/HO maintains copies of official AF records as provided by AFHRA such as emblems and L&H. AFSOC/HO maintains	4,754 files	3.11BG	N/A	AFHRA; subordinate units

	additional reference material on active emblem revisions and copies of inactivated units L&H. File types include PDF, DOCX, JPG, JNG, and TIF				
Annual History Reports (AHP)	AHPs from 1990-2000 were paper and subsequently digitized as PDF's. Since 2000, all AHPs are digital born assets. File types include DOCX, XLSX, PDF, JPG, and MP4, MP3.	17,721 files	50.9GB	1 original PDF copy, two archival discs (one provided to AFHRA per AFI)	Files originate with HQ AFSOC directorates and subordinate units.
Historical Photography	Various photos from 1940s to current era	7,835 files	64.4GB	No minimum required. Recurring efforts to review collection reveals duplicates in collection	Subordinate units, various govt resources, public affairs
Reference and Research Material	Studies, monographs, leadership	7,059 files	68.4GB	1xExt HDD and 1xAF	Various sources within AF

	biographies, honors and decoration citations			Network BUP	

2. **File Naming:** Please identify how file names are constructed for DAGs (is there a standard naming convention used throughout AFHMP).

   Reference and Research materials and historical photography file names do not follow a standard naming convention.

   AFSOC/HO follows the current modified naming convention of AFHMP.

   For Air Force History Reports, files are named in the following manner:

   File Folder # - Sup Doc # | (classification and admin control marking) | yyyymmdd | 60-character max description

   EXAMPLES:

   05-1015 (U) 20220527 Wing Reorg COMAFSOC Decision Brief

   05-1234 (U) 20221105 COMAFSOC RoD 1 SOW Reorg

3. **Accessibility:**

   a. Identify the location(s) and environmental conditions at which the DAGs are preserved (check all that apply):

	Regular Office environment	**Specialized Environment (please elaborate)**	**Warehouse/Other**	**Condition Unknown**	**Do you believe the DAGs stored here are at risk?**
Network server room (for shared drives or Web server space	Unknown	Unknown	Unknown		Unknown, subject to AF Comm guidance.

controlled by AF)					
Storage Vault or Archive Room	AFSOC/HO has five GSA secured vaults for classified digital assets.	AFSOC/HO does not have a dedicated HVAC system; temps/humidity subject to set bldg. standards	N/A	N/A	Archives have fire suppression system and located above ground level. Risks include fire/water damage and hurricanes.
Regular office space	N/A	N/A	N/A	N/A	N/A
Off-site storage (record center, cloud space)	HAF/HO data enclave; selected published studies are maintained there. No AHPs or other DAGs are stored on the enclave.	Unknown	Unknown	N/A	Pending HAF/HO guidance

b. Is the information backed up in a data repository?

YES / NO / **UNSURE**

4. **Security Protocol:** Please indicate any access restrictions regarding each DAG:

Name of DAG	**Can the DAG be displayed in a museum exhibition**	**Does it need a trigger warning (if so, why)**	**Is it only viewable to those with a need to know**	**Can it be published online**	**What is the overall security classification for the DAG (i.e., unclassified, CUI, Secret, etc.)**

Air Force Organizational Records	Only unclass info	Unknown	Yes	AFHRA maintains online copies of active unit L&H and embelms	Unclassified, CUI and Secret
Ref and Research	Only unclass info	Unknown	Yes	Some items (books, background papers, etc.)	Secret, Unclass and CUI

5. **Freedom of Information Act (FOIA):** Are there any collections that require a formal FOIA request or mandatory declassification review before release? If so, which ones?

   Annual histories require a formal FOIA request and/or a Mandatory Declassification Review (MDR). Once classification status is determined, reviews by Public Affairs and Staff Judge Advocate are required to make final determination regarding public release. Information may not be released if it identifies current tactics, training, or techniques utilized by Air Force units. Controlled Unclassified Information (CUI) is reviewed by Public Affairs to ensure Personal Identifiable Information (PII) is not released.

6. **Collection Needs:**

   a. **Physical security:** what security measures are in place to protect digital assets?

      i. **Classified is held in safes and official histories both paper and electronic are archived at AFHRA.**

   b. What tools – software or hardware – are used in generating the data?

      i. **Typical hardware is electronic scanner and or digital camera. Software is relates to Adobe Acrobat and/or Microsoft Office.**

   c. What tools – software or hardware – are used to understand the data?

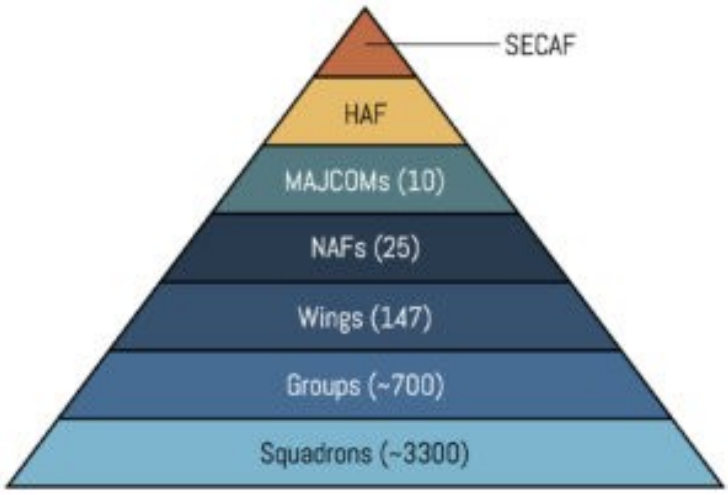
      i. **Desktop computer utilizing above mentioned software.**

7. **Usability:**
    a. **Target Audience:** Whom would you imagine this data's primary consumer? (military researchers, installation command team, veterans, reserve, active-duty soldiers, etc.)
        i. **Commanders at all levels in AFSOC, leaders and decision makers.**
        ii. **Future researchers at all levels where information is available to the public after official release.**
    b. How do you anticipate the data will be employed by the target audience listed above?
        i. **Study of prior operations to make current decisions.**
    c. What are the most critical parts of the data to preserve for your target audience (manage and maintain over time)?
        i. **Official histories of AFSOC at all levels.**
    d. Is there anything else the interviewer should know about the data you preserve?
        i. **Understand that AFSOC, although an Air Force MAJCOM is tied to the joint community under the combatant command USSOCOM. While not official in the archiving process, most unit histories are shared with the USSOCOM History office to assist in building their official history. Every AFSOC history has materiel that is classified no higher than SECRET//NOFORN although a considerable amount of information within the history is unclassified. Conducting an MDR on official histories at the MAJCOM History Office cannot be**

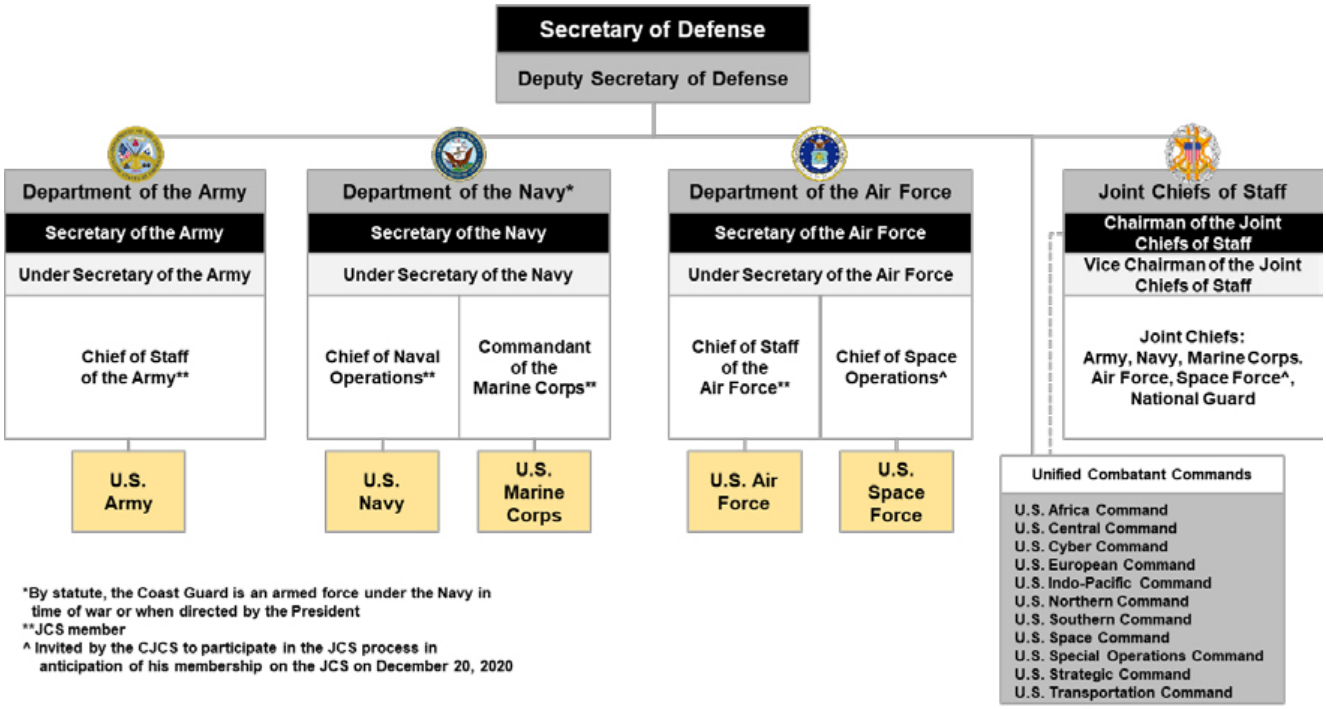
accomplished as all information is derivative. Therefore, release of the information is not part of the office duties.

Appendix B – Acronyms and Figures.

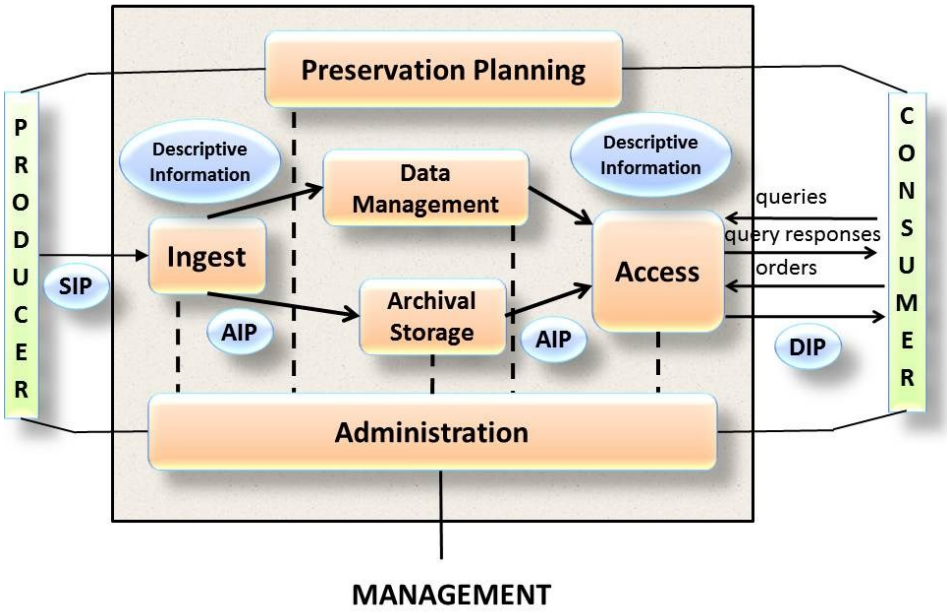
- AFHMP – Air Force History and Museums Program
- AFHRA – Air Force Historical Research Agency
- AIP - Archival Information Package
- Air Force Organizational Structure. Source: (Friedel, 2022).



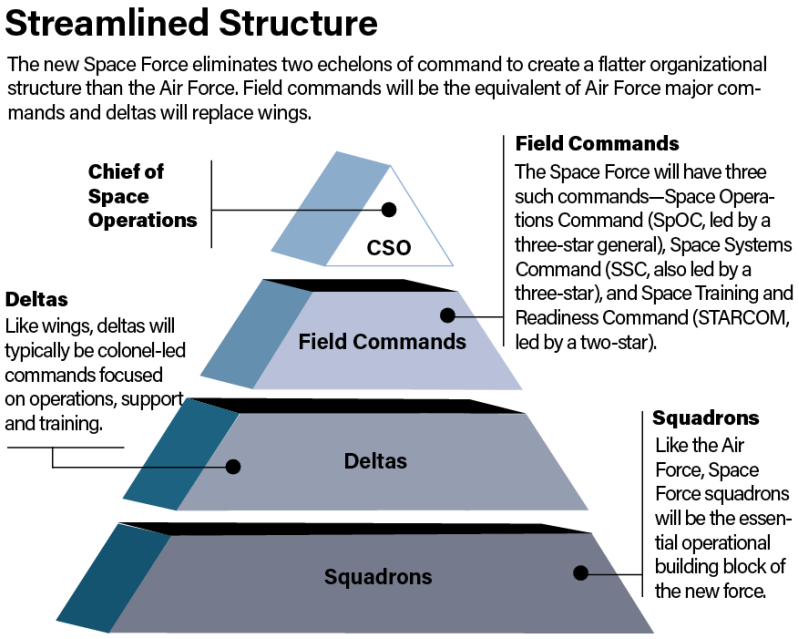
- AMC – Air Mobility Command
- CCI - Canadian Conservation Institute
- CHIN -Canadian Heritage Information Network
- Classification Marking – Air Force archives preserve varying levels of controlled data. The level of security is marked with a U (unclassified), CUI (controlled unclassified information), S (Secret), and more.
- DAF – Department of the Air Force
- DCC – Digital Curation Centre
- Department of Defense Organizational Structure. Source: USAF



- DIP - Dissemination Information Package
- DoD – Department of Defense
- DPC - Digital Preservation Coalition
- FedRAMP - Federal Risk and Authorization Management Program
- HO – History Office
- HQ – Headquarters
- MAJCOM – Major Command
- NAF – Numbered Air Force
- NARA – National Archives and Records Administration
- OAIS - Open Archival Information System Reference Model. Source: (Giaretta, 2011, p. 277).



- SIP - Submission Information Package
- SOA - Special Operating Agencies
- Space Force Organizational Structure. Source: (Cohen, Goodbye Wings, Hello Deltas, 2020).



- TDR – Trusted Digital Repository

- TRAC Checklist – Trustworthy Repositories Audit & Certification
- USAF – United States Air Force. Also known as AF.
- USSF – United States Space Force
- USSOCOM – United States Special Operations Command