Meeting the Challenge of Media Preservation:

Strategies and Solutions

INDIANA UNIVERSITY
BLOOMINGTON

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Indiana University Bloomington
Media Preservation Initiative Task Force

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Our history is at risk

Indiana University Bloomington is home to at least 3 million sound and moving image recordings, photos, documents, and artifacts. Well over half a million of these special holdings are part of audio, video, and film collections, and a large number of them are one of a kind.

These invaluable cultural and historical gems, and many more, may soon be lost. Forever.

IMAGES, PREVIOUS PAGE:

■ The Archives of African American Music and Culture has ninety-one audiocassettes of interviews conducted by Michael Lydon with Ray Charles and his associates as background for the book *Ray Charles: Man and Music*. Image from IU News Room.

■ Gloria Gibson, Frances Stubbs, and founding director Phyllis Klotman pose in 1985 with part of the Black Film Center/Archive's rich collection of films and related materials by and about African Americans. Photo courtesy of the Black Film Center/Archive.

■ *The Blackbird* (1926), starring Lon Chaney, is one of many historically important films found in the David S. Bradley Collection. Photo courtesy of Lilly Library.

■ Herman B Wells was an educational visionary who helped transform Indiana University into an internationally recognized center of research and scholarship. In this 1950 photo, Wells is pictured with Eleanor Roosevelt, who was First Lady of the United States from 1933 to 1945.

■ In 1947 Bill Garrett broke a color barrier in major college basketball by becoming the first black player signed in the Big Ten. He led the team in scoring and rebounding and was a First Team All-American.

■ The African American Arts Institute holds unique recordings of interviews with Cab Calloway and other prominent musicians. Photo by William P. Gottlieb, Library of Congress.

■ The 100th birthday of Josef Gingold was celebrated in 2009 with a performance by two of his most prominent students, Joshua Bell and Jaime Laredo, one of many concerts for which master recordings are held by the William and Gayle Cook Music Library. Photo courtesy of the IU Jacobs School of Music.

■ The Archives of Traditional Music preserves many field recordings made around the world including those by ethnomusicologist Laura Boulton, seen here recording in Alaska in 1946. Photo courtesy of the Archives of Traditional Music.

■ The Lilly Library has an unparalleled collection of lacquer disc recordings of speeches made by Wendell Willkie in connection with the 1940 presidential campaign. Detail of Willkie campaign poster, Library of Congress.

■ A highlight of the Black Film Center/Archive is the collection of documentary filmmaker Peter Davis, who took this photograph of his soundman David Mesenbring while working on one of his projects in Transkei in 1985. Image from the Peter Davis Collection at the Black Film Center/Archive.

■ The original open reel tapes at the Lilly Library of Peter Bogdanovich's legendary 1963 interview with Alfred Hitchcock served as the basis for the book *The Cinema of Alfred Hitchcock* (1963). Photo by Fred Palumbo, Library of Congress.

■ IU holds recordings of Hastings Kamuzu Banda, one-time IU student and the first president of Malawi. Banda is photographed in 1964 with Peter Youens, then-secretary to the Prime Minister and the Cabinet of Malawi.

■ The William and Gayle Cook Music Library has unique recordings of concerts by the renowned Beaux Arts Trio spanning half a century of its history. Photo courtesy of the IU Jacobs School of Music.

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Executive Summary

Background

The Indiana University Media Preservation Survey Report, published in 2009, identified 560,000 audio, video, and film objects on the Bloomington campus. Many are degrading, most are on obsolete formats, a large percentage of them are highly valued for research, and there are no sustainable plans to preserve them. Most are unusable assets, locked into a form in which they are neither preservable nor easily accessible unless transformative action is taken soon.

In response to these findings, the Media Preservation Initiative Task Force was created in 2010 and charged with developing plans for a campus media preservation center, establishing strategies for preservation prioritization, exploring media access issues, analyzing IU's technology infrastructure, and investigating how the results of preservation work would engage existing campus research and instruction.

After a year of research and planning, it is abundantly clear that Indiana University Bloomington is well-positioned and ready to initiate concerted, coordinated, and comprehensive action that will result in the successful long-term preservation of its media holdings with consequent access for researchers. This report charts solutions and lays the groundwork for unlocking campus media assets and transforming them into usable resources. IU Bloomington has considerable expertise and experience that can be leveraged to build preservation infrastructure from a position of strength. Preserving and making media holdings widely available in a sustainable way will revolutionize the use of archival media for research and teaching and enable IU Bloomington to assume national leadership in this area.

The media preservation crisis impacts every institution with media collections. The Library of Congress has published three studies exploring these issues, formulating national plans for film, audio, and television video heritage. Within our region, CIC institutions hold at least 2 million audio, video, and film objects, yet no other CIC institution has completed a comprehensive survey of holdings, a plan for preservation and access, or is pursuing campus-wide digitization for preservation.

On the Bloomington campus, Media Preservation Initiative work aligns with strategic plans including the President's core *Principles of Excellence*, University Information Technologies Services' *Empowering People: Indiana University's Strategic Plan for Information Technology 2009*, the Office of the Vice Provost for Research *Five-Year Strategic Plan 2008-2013*, and the IU Libraries *Mission Statement*.

Preservation Planning

Media archives have reached a critical point in their history. Rapidly advancing obsolescence, combined with degradation of carriers and multiplied by large numbers of archival recordings, forces a race against time to preserve important holdings. These factors, as well as consultation with leaders in media archiving, compelled the Task Force to define a fifteen-year target to digitally preserve audio and video holdings. Even motion picture film, which has a different set of preservation concerns than audio or video, is at risk if not stored properly. All

face increasing barriers to access as playback equipment becomes increasingly hard to find and maintain.

The foundation of the Task Force's preservation planning is a set of principles created to guide the development and implementation of preservation strategies. These principles support efficient, accurate, sustainable, and enduring work as well as cooperation between stakeholders. They serve as a reference point for decisions as preservation planning and implementation move forward.

An examination of steps in the preservation process confirmed that IU Bloomington must build media preservation infrastructure regardless of whether digitization is tackled in-house or outsourced to a vendor. Functions such as prioritization for preservation, quality control of digitization products, and long-term storage must be successfully completed on the Bloomington campus under either scenario.

Evaluating the advantages and disadvantages of building in-house digitization capabilities versus outsourcing resulted in the identification of a set of factors unique to our campus that make a powerful case for building a comprehensive facility at Indiana University Bloomington. This analysis concludes with a data-driven model that demonstrates significant cost savings for the local build option.

Planning to build for digitization led to an analysis of workflow options that forced the Task Force to define where the intersection of preservation principles and time pressures (as realized in more, or less, efficient workflows) lies for our institution. The key product of this analysis was construction of the "Indiana Approach" to preservation transfer work, which maintains preservation principles within a high efficiency workflow. This approach reaches campus preservation targets within the defined fifteen-year time period while addressing preservation concerns and supporting high quality work.

Because campus holdings are very large and time pressures great, even high-efficiency workflows may not preserve everything in time. In addition, not every recording is an appropriate candidate for long-term preservation. For these reasons, the Task Force worked with campus stakeholders to define a structured process for prioritizing media collections by research value as well as preservation condition in collaboration with curatorial staff.

Strategies for Film

Indiana University Bloomington holds one of the largest and most diverse collections of film at any university in the United States with 80 percent of holdings residing in the IU Libraries.

The cornerstone of IU Bloomington's preservation strategy for film is storage in the Auxiliary Library Facility which maintains 50°F and 30 percent relative humidity, buying time for the maturation of preservation methodologies. Although this provides stability, film is not readily accessible for research when stored in these conditions. Digitization, which is not yet considered a viable long-term *preservation* strategy for film, is a key to widespread *access* to film content. Digitization technologies for film are evolving rapidly, and a gradual start to access digitization is recommended. When technologies mature, a rapid and massive digitization effort must be initiated to preserve and provide access to film content.

Making large portions of campus film holdings accessible via digital files represents a significant strategic opportunity as relatively few others are doing so. In today's media-

saturated culture, users are less likely to be audiences in a theater than individuals connected to content online. These users want direct, unchaperoned access to content—a need that is best met through web delivery.

The recent opening of the IU Cinema provides a welcome opportunity to also prioritize access to campus archival film through the more traditional projection-in-a-theater experience. We are already cultivating close working relationships with cinema staff, collaborating with them to select appropriate titles and providing prints for projection.

Facility Planning

The Task Force recommends building the Indiana Media Preservation and Access Center (IMPAC) to undertake preservation transfer (digitization) of audio and video recordings plus both conservation and access digitization of film. The IMPAC build plan was developed through a strongly data-driven process, using information on campus time-based media collections combined with analysis by Task Force members and consultant AudioVisual Preservation Solutions. The results of this work provide defensible estimates of what is necessary to reach our defined targets—digitally preserving and/or providing access to 284,000 audio recordings, 66,000 video recordings, and 58,000 film objects within the fifteen-year time frame. These represent the portion of IU Bloomington's holdings that we estimate are strong candidates for preservation or, in the case of film, digitizing for access.

To accomplish this task, we propose a 10,000-square-foot facility with 21 rooms, employing 25 staff. Staff will include administrators, audio and video engineers, film specialists, processing technicians, and IT support. We estimate that this facility will output 2-3PB of data per year with a total fifteen-year target of 39PB of data storage. This plan also includes a Strategic Media Access Resource Team (SMART) made up of graduate students and led by IMPAC staff that will visit each unit and assist in the preparation of holdings for preservation transfer.

Access

Research, instruction, curation, and public availability are core university missions supported by media preservation efforts. Unit curatorial staff play key roles in directing access and use, but university leadership and resources for technology infrastructure and for the development of policies and guidelines is needed.

Access is the end goal of any preservation work, and it must be developed in tandem with media preservation efforts. To guide the creation of policies, outline issues of development, and establish a foundation for further work, the Task Force has created a set of access principles for the campus. These principles are a companion to the preservation principles and will be the starting point for a series of working groups that will define access policies and procedures. Underlying this work is a vision to establish IU Bloomington as a leader in access to time-based media collections in the next five years. We possess some of the key elements of a comprehensive media access system but additional work and development are needed to create an integrated system.

Technology Infrastructure

Indiana University's existing infrastructure and expertise in the areas of research storage, high-performance networking, digital libraries, and media streaming place it in a strong and unique position among research universities to provide the capabilities required for the media

preservation and access plan developed by the Task Force. Development of these capabilities is already supported by the 2009 UITS strategic plan, *Empowering People*.

Key pieces currently existing or under development include a Fedora-based preservation repository system, Trusted Repositories Audit and Certification work, the Scholarly Data Archive (SDA), media transcoding, media streaming, and metadata conversion systems. Media preservation will require completion or expansion of these systems and services. In some cases, such as the preservation repository system, additional developer personnel in the Digital Library Program are essential to complete this work in time to ingest large amounts of data generated by the IMPAC. In other cases, such as the SDA, expansion will be required. The Media Preservation Initiative will be the largest single contributor to the SDA, although by year five, its proportion of SDA total campus storage will be only 9 percent. Additional development personnel are needed to develop preservation repository services on the SDA side and to extend or create key pieces of software for workflow automation and efficiency.

Campus Engagement

Media Preservation Initiative (MPI) work broadly engages Indiana University Bloomington's research, teaching, and service missions. MPI Task Force recommendations build upon existing campus resources and strengths to implement solutions to the media preservation and access crisis. It is with existing strengths that we find the deepest engagement, including close connections between the IMPAC and the IU Libraries, integral support from UITS, critical development work at the Digital Library Program that supports media preservation and access, strong collaborations with special collections units, and a partnership with the IU Cinema.

It is also evident to the Task Force that media preservation and access work intersect with multiple present and future research and instructional agendas of IU Bloomington faculty, staff, and students. Faculty and students will have access to the vast and renowned audio, video, and film holdings owned by IU Bloomington. At a time in which access to media is increasingly a research imperative and an instructional benefit, this will be a significant advantage. MPI work offers rich engagement with campus research and instructional priorities.

The work of the IMPAC will not suddenly end after the target fifteen-year time period. Increasingly, new media acquisitions will be digital file-based and will require active preservation and access workflows to survive. Plus, putting the IMPAC into operation will act as a magnet, attracting desirable new collections in older formats. The Task Force also envisions opportunities outside of Bloomington on other IU campuses or at CIC institutions, for example. We also expect demand for media preservation services from other continents beyond the next fifteen years. Given Indiana University's strong international ties, this could result in additional fruitful partnerships.

Next Steps

During its first year of work, the Media Preservation Initiative Task Force focused on developing solutions to the challenges posed by legacy media. In year two, we will turn our attention to developing management strategies and workflows for file-based born digital recordings. The Task Force has identified a number of other objectives for its second year of work including exploring partnerships with other institutions, developing a prioritization plan with units, managing the IMPAC startup plan described below, and working with architects on facility design and development.

The Task Force has developed a plan to leverage existing resources on the Bloomington campus to begin IMPAC work before construction of the facility. This startup plan is a collaboration with the Music Library, Radio and Television Services, the IU Libraries, and the Archives of Traditional Music. It will enable us to begin preserving IU Bloomington audio and video collections slowly but steadily, expand conservation work on film, test proposed workflows, demonstrate proof of concept, and gain experience. It will also result in the creation of a small body of extremely high value preserved content for use with stakeholders and potential donors.

Conclusion

The technology and expertise to fully realize the scenarios and recommendations detailed in this report currently exist at IU Bloomington. It is now possible to move forward into a new era of preservation and access for media holdings, an era characterized by a wealth of enduringly preserved and easily accessed media content integrated into campus research and instruction.

1 Prologue

Revisiting *Danton and Robespierre*

Indiana University's Media Preservation Survey Report, published in late 2009, opens with the story of two videotapes sitting on the desk of Cook Music Library Director Phil Ponella. The videotapes document the world premiere of John Eaton's opera *Danton and Robespierre*, performed in the Musical Arts Center on April 21, 1978. The performance featured then student, now IU Distinguished Professor Emeritus Tim Noble as Robespierre. Noble is a Grammy-nominated singer with a career that includes leading roles at the Metropolitan Opera, The Chicago Lyric, and the La Fenice in Venice, among others. Composer John Eaton is a former IU faculty member and three-time winner of the Prix de Rome who has received the "genius" award from the MacArthur Foundation. The tapes are important one-of-a-kind recordings exhibiting serious degradation making them unusable to researchers, and Ponella wanted to keep track of them.

A recent visit reveals that the tapes remain on his desk. Here is why: No unit on the Bloomington campus is able to undertake video preservation transfer work to current best practices, there is no line item in the Music Library's budget for outsourcing media preservation work, and there is not a media preservation infrastructure in place to properly manage and maintain a preservation copy. These particular recordings are only the proverbial drop in the bucket. A number of world premieres and other highly valuable recordings at the Music Library and other campus units are in similar dire straits. There is currently no way for a campus unit to save large numbers of media recordings like these that have inestimable value to IU Bloomington and to the world.

Survey Results

This final report of the Indiana University Bloomington Media Preservation Initiative's (MPI) year-long planning project presents solutions to this problem, beginning where the 2009 Survey Report left off. The Media Preservation Survey Report detailed the campus problem, which is summarized in the box below.

Summary of Media Preservation Survey Findings

- More than 560,000 audio, video, and film objects are owned by the Bloomington campus on more than fifty formats housed in more than eighty units.
- Nearly all are actively degrading, some catastrophically.
- Nearly all are on obsolete formats.
- An estimated 180,000 are at high or very high risk for loss of content over the next decade.
- An estimated 44 percent are unique or rare recordings.
- Large numbers have significant national and/or international research value.
- We have only a fifteen- to twenty-year window of opportunity to digitally preserve audio and video holdings.
- At its current pace, the largest media-holding unit—the Music Library—will need 120 years to preserve its recordings. Most units have no resources at all for media preservation.

The Survey Report garnered significant attention. In a section titled "Learning from Bloomington," the national audio preservation study published by the Library of Congress and the Council on Library and Information Resources called it

> *...a significant work, not only as an analysis of the scope of challenges faced in Bloomington but also as a model of survey design, interpretation of data, presentation of useful information, and constructive recommendations for further action....Custodians of audio collections and preservation administrators elsewhere would be wise to consider the application of many, if not all of the recommendations in the Indiana study.*[1]

A number of institutions consulted with IU Bloomington staff on the project's process and results. The project also enabled Indiana University to engage deeply in an ongoing international dialog on media preservation challenges.

Media Preservation and Access Planning

To address the challenges laid out in the Survey Report, the IU Bloomington Provost appointed the Media Preservation Initiative Task Force and initiated a year-long preservation and access planning process. This effort was funded by the Office of the Vice Provost for Research, University Information Technology Services, the IU Libraries, the College of Arts and Sciences, and the Office of the Provost. The Task Force, directed by Associate Vice Provost Ruth Stone, organized a smaller working group, charged with carrying out project research, and a campus advisory board of key stakeholders to provide high-level advice and guidance. The Task Force also convened an international external advisory board with representatives from the Library of Congress, National Archives and Records Administration, National Library of Australia, National Library of Canada, and several American universities. This external board met in person during the joint conference of the International Association of Sound and Audiovisual Archives and the Association of Moving Image Archivists.

This report presents the findings and recommendations of the Media Preservation Task Force from its first year of work. It outlines solutions appropriate to IU Bloomington that will result in the preservation of, and consequent access to, media holdings with high research value. These solutions developed from campus experience, expertise, contexts, and perspectives. They align with a number of campus strategic initiatives. This report details:

- preservation principles to guide campus work,
- factors that impact the decision to build in-house digitization capabilities or outsource,
- a build plan for a central digitization facility named the Indiana Media Preservation and Access Center (IMPAC),
- the "Indiana Approach" to audio and video digitization,
- strategies for film preservation and access,
- a process for prioritizing campus media holdings for preservation treatment,
- access principles to guide campus work,
- existing applicable technological infrastructure along with gaps and future needs,
- preservation pilot projects to test technical choices and validate workflows.

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[1] *The State of Recorded Sound Preservation in the United States: A National Legacy at Risk in the Digital Age*, CLIR publication no. 148 (Washington, D.C.: Council on Library and Information Resources and Library of Congress, 2010), http://www.clir.org/pubs/reports/pub148/pub148.pdf, 12, accessed July 1, 2011.

Strategic Opportunities

Indiana University Bloomington is not the only institution facing this challenge. The media preservation crisis is international in scope and affects every institution with significant media holdings including most American universities. Over the past fifteen years, this crisis has been the subject of national studies and plans completed by the Library of Congress for film, video, and, most recently, audio.[2] IU Bloomington is well positioned to lead in this arena. We know the extent of our holdings and their condition as a result of the survey. Institutional staff has considerable expertise in critical areas including audio preservation, film preservation, film presentation, digital libraries, networks, data storage systems, archival management, access systems, and others. Campus projects have already developed an access system for audio (Variations), scholarly tools and access for ethnographic video (EVIA), international best practices for audio preservation (Sound Directions), software for audio preservation metadata, recommendations for preservation transfer methodologies, a mass storage system (SDA), beginning development of a preservation repository (Digital Library Program) and others.

Herein resides a key strategic opportunity for Indiana University to assume a national leadership role. With so much already in place, IU can leverage existing resources and fill in the gaps rather than starting from scratch. With so few existing media preservation programs nationally, IU Bloomington is in a strong position not only to meet its own challenges, but to lead and provide services to other institutions.

Indiana University Bloomington is poised for a media preservation and access paradigm shift. It is now possible to move forward into a new era that will revolutionize the use of archival media for research and teaching.

The Old Way

Indiana University Bloomington is poised for a media preservation and access paradigm shift. Two scenarios from Task Force user studies illustrate current, inefficient methodologies:

> *Ethnomusicology Associate Professor Judah Cohen has located an audio recording of interest in an archive an eight-hour drive away. He contacts the archivist about getting a research copy and learns that the tape will need to be digitized in advance of his arrival. When he arrives, he is given a CD copy of the recording for listening inside the archive. Judah is glad he made the trip because he finds that this recording will greatly contribute to his research. However, he is not allowed simply to import the material to his computer on-site, a five-minute task. Instead, he must formally request a research copy, fill out several sheets of paperwork, pay $25 for the archivist to copy the CD copy to a blank CD, pay $15 in shipping costs, and wait at least two weeks for them to mail him the CD. Realizing that the process would be the same whether he is on site or off site, he decides to forego his request until he deems it economically viable.*
>
> *Professor Portia Maultsby uses archival collections for teaching. She needs more than just audio examples; she also needs sheet music and images to better illustrate the context of the collection pieces. She brings a large stack of CDs to class containing copies of song clips*

[2] See reports cited in footnotes 1, 9, and 12.

taken from the archive. She navigates through multiple CDs, shuffling between tracks, finding clips within tracks. Separately, she shows images to the class. Portia requires students to use archival materials in classroom assignments. Students often bring books to class and hold up the examples to show to their classmates; however, most items from the archive are non-circulating.

The New Way

With media collections digitized and access provided online, the above scenarios might unfold like this:

Judah Cohen locates an audio field recording of interest from an online search of an archive's holdings. He registers with the archive by completing a short online form and is given access to a streaming copy of the recording. He listens over and over, taking advantage of online tools to slow it down for analysis. He selects 60 seconds of particular interest and adds it to his personal playlist. Judah decides that downloading a high-resolution copy would aid his research so he files a request online. A rights management system running in the background determines that this recording is available for this proposed use (or not, as appropriate), and he is able to obtain his own copy.

Portia Maultsby arrives for class and logs in to an online media access system. She opens a playlist she created the previous evening and begins teaching. From the playlist, Portia seamlessly accesses media clips of different lengths from different sources to illustrate key lecture points. The playlist provides access to images, which are also integrated into the lecture. Students use their own playlists for class projects and presentations.

The technology and expertise to fully realize these scenarios currently exist at Indiana University Bloomington. Media content with nearly unlimited research and educational potential is held by campus units. It is now possible to move forward into a new era of preservation and access for media holdings, an era that will revolutionize the use of archival media for research and teaching. This report lays the groundwork for moving forward.

2 Media Preservation Initiative Task Force Recommendations

Task Force work resulted in a set of core recommendations for preserving and providing access to IU Bloomington media holdings. These are presented below by topic, not in the order in which they appear in this report. Please refer to individual sections of the report using the chapter number in brackets for context and arguments related to any given recommendation.

Preservation Planning

- Preserve audio and video holdings within fifteen years to combat the threat presented by ongoing degradation and rapidly advancing obsolescence. [Chapter 4]
- Use preservation principles developed by the Task Force to provide sound guidance for preservation-related decisions. [Chapter 4]
- Build in-house digitization capabilities for most campus media formats to meet IU Bloomington goals and expectations, leverage existing resources and expertise, and reduce the cost of preservation. [Chapter 4]

Facility Development

- Build the Indiana Media Preservation and Access Center (IMPAC) to efficiently and cost-effectively preserve IU Bloomington holdings. [Chapter 6]
- Enact the IMPAC start-up plan immediately to test workflows, gain preservation experience, utilize existing campus experience and resources, and engage in other critical activities in preparation for future IMPAC operation. [Chapter 10]
- Explore the feasibility of using second-shift excess capacity to provide services to other institutions and/or IU faculty. [Chapter 6]
- Form a Strategic Media Access Resource Team (SMART) made up of graduate students supervised by IMPAC staff to help IU Bloomington units prepare holdings for digitization. [Chapter 6]

Facility Operation and Workflow Development

- Collect a minimal set of descriptive metadata to support an efficient digitization workflow. Support later work on full description, including cataloging and the development of finding aids, by making digital files of preserved content available to catalogers and/or other unit staff. [Chapter 6]
- Collect a rich set of technical metadata to fully support future interpretation and management of digital content. Support the rapid development of the software application ATMC for this purpose. [Chapter 6]
- Use a 1:1 digitization workflow in combination with 2:1 and 4:1 parallel transfer workflows to both meet campus preservation goals and complete preservation transfer work within fifteen years. [Chapter 4]
- Develop an IMPAC quality assurance and quality control plan. [Chapter 6]

- Develop software applications to automate as many tasks as possible to support high-efficiency workflows. [Chapter 4]]

Prioritization

- Prioritize campus media holdings for preservation by conducting a structured assessment of research value and preservation condition with each media-holding unit. [Chapter 4]
- Fully involve unit curatorial and/or custodial staff in the prioritization process [Chapter 4]
- Develop a five-year prioritization plan as soon as possible followed by priorities for the remaining holdings over the ensuing ten years. [Chapter 4]
- Pursue the rapid development of the research value assessment tool RIVERS for use in the prioritization project. [Chapter 4]

Strategies for Film

- Store all campus film holdings in the Auxiliary Library Facility to ensure their survival. [Chapter 5]
- Seek funding for film-to-film preservation of the most severely degraded items with the highest research value or of greatest national importance. [Chapter 5]
- Undertake a close watch of digitization technologies with a formal analysis within five years to identify strategic opportunities to pursue massive digitization for preservation and/or access purposes as appropriate. [Chapter 5]
- Allocate resources to complete the rapid and massive digitization of film holdings once technologies mature. [Chapter 5]
- Begin a phased access digitization program immediately to provide researcher access and to aid the long-term preservation of content. [Chapter 5]
- Develop a strong partnership with the IU Cinema for the screening of archival film. [Chapter 5].

Technology Infrastructure Needs

- Prioritize preservation repository development so that ingest of audio, video, and film content may begin within six months of the start of IMPAC operations. Basic IMPAC workflow tools should be in place within three months. [Chapter 8]
- Develop repository preservation services including ongoing data integrity checking. [Chapter 8]
- Hire three programmer/analyst positions for preservation repository development and support. [Chapter 8]
- Evaluate options for media transcoding and adopt specific recommendations. [Chapter 8]
- Working with UITS, determine optimal IMPAC network design and costs once a facility location has been identified. [Chapter 8]
- Determine storage and bandwidth requirements for media streaming and evaluate how MPI needs fit with existing campus resources. [Chapter 8]
- Assess IU Bloomington unit needs for collection and object management tools. [Chapter 8]

Access

- Appoint a task force that will develop specific recommendations for broad media access issues at IU Bloomington. These recommendations should address the access principles and issues related to stewardship, special collections policies, curatorial responsibilities, metadata management and discovery systems, and rights management. [Chapter 7]
- Expose both tangible media holdings and digitized content to search engines and discovery environments as widely as possible. [Chapter 7]
- Create derivatives of all preserved content that enable items to be delivered online, with systems and policies in place so that access can be controlled in accord with legal requirements and ethical standards. [Chapter 7]
- Provide a basic but extensible infrastructure for media access that serves research, instruction, media production, and the administration of media assets. [Chapter 7]

Collaboration

- Develop a media preservation track within the School of Library and Information Science. [Chapter 4]
- Develop partnerships with other institutions, particularly within the CIC, that feature the provision of joint media preservation services. [Chapter 4]

3 Background

Key Points

The media preservation crisis impacts every institution with media collections. The Library of Congress has published national studies exploring these issues for audio, film, and television and video heritage.

CIC institutions hold at least 2 million audio, video, and film objects and likely many more.

- CIC digitization activities are largely for production purposes, not preservation.
- No other CIC institution has completed a comprehensive survey of holdings, a plan for preservation and access, or is pursuing campus-wide digitization for preservation.

Media Preservation Initiative work aligns with strategic plans on the Bloomington campus including

- The President's core *Principles of Excellence,*
- University Information Technologies Services' *Empowering People: Indiana University's Strategic Plan for Information Technology 2009,*
- Office of the Vice Provost for Research *Five-Year Strategic Plan 2008-2013*, and
- IU Libraries Mission Statement.

Provost's Charge to the Media Preservation Initiative Task Force

From: Karen Hanson
Provost and Executive Vice President

CC: Sarita Soni, Vice Provost for Research

Date: August 9, 2010
Re: Research Media Access and Preservation Taskforce

The Bloomington campus of Indiana University possesses unusually rich special collections by virtue of a singular history guided by the late Chancellor Herman B Wells. Many of our archives and collections have achieved national and international prominence because of the quality and extent of their holdings.

The 2008–09 IUB Media Preservation Survey identified more than 560,000 audio and video recordings and reels of motion picture film owned by Indiana University and stored on the Bloomington campus. The subsequent report, published in August of 2009, demonstrated that large portions of many of these holdings are seriously endangered by degradation of the media, format obsolescence, and inadequate storage. Many of these recordings are highly significant for research, documenting

subjects of enduring value to the university, the state of Indiana, the United States, and the world.

It is now widely recognized that audio and video holdings must be digitally preserved within an estimated fifteen- to twenty-year time window if they are to be available to future generations of researchers. After that, digitization may be impossible or prohibitively expensive because of degradation or obsolescence problems. In addition, film holdings must be assessed, tested, treated, and stored in appropriate climatic conditions if they are to survive. All media holdings must be cataloged so that researchers may locate and work with them.

We must take action now if these significant research holdings are to survive and be available for use by future generations. The IUB Media Preservation Survey and its report are cited as a model by a number of national and international institutions. We now have an opportunity to provide additional leadership by developing a model action plan to address issues of preservation and access.

Thus, I am asking you to serve on a task force to develop a comprehensive campus-wide plan for the timely preservation of high-value audio, video, and film holdings. Ruth Stone has kindly agreed to chair this taskforce. This plan will address a number of issues, but I am asking that the task force specifically undertake the following:

1. Develop plans for the creation of a campus media preservation digitization center to digitally preserve audio and video recordings while also conserving and providing access to film. This work must include a specific proposal with architectural plans, staffing needs, budget, renovation costs, ideas for sustainability, and possible funding sources. If a permanent center does not seem reasonable, suggest alternatives that will effectively accomplish the same ends.

2. Establish priorities for preservation treatment based on a structured analysis of both research value and degradation. This should include a statement of principles upon which prioritization decisions are made as well as articulation of a strategy for preserving IUB's vast holdings over time. Because campus holdings are large and diverse, it may be necessary to pursue prioritization in stages, of which this would be phase one.

3. Develop strategies for making preserved content accessible as appropriate to faculty and students for both classroom and research use as well as to researchers located both on- and off-campus.

4. Analyze how the above tasks intersect with plans for the development of a research commons in Wells Library as well as with campus priorities for research, existing special collections at IUB, the Institute of Digital Arts and Humanities, the University Cinema, and the Library's Digital Library Program.

5. Analyze the state of IU's technology infrastructure for preservation and access services, prioritize needs, and develop plans that address both the strategies outlined above for faculty and student use as well as the institutional needs for special collection management and growth across campus.

This work should proceed with the full involvement of key campus stakeholders including special collections curators and staff, Wells Library administration, OVPR, UITS, the Library's Digital Library Program, and the Director of IU Cinema.

I would like to receive your report and recommendations by mid-April 2011. Thank you very much for undertaking this crucial effort.

National Landscape

The media degradation situation at Indiana University is not unique across the country or around the world. While scholars and laypeople have eagerly created and consumed time-based media since the first identifiable sound recording in 1860,[3] few systematic efforts have addressed large-scale preservation for the future. A parade of formats, beginning with cylinders and continuing to include discs, motion picture film, wires, video and audio tapes, DATs, and CDs have appeared in university collections over the years as scholars and producers used them to document historical and cultural events or research data. Archivists know that these formats created and discarded by commercial industries have never come with a road map for their future preservation. Within the last decade, archivists have worked diligently towards a concerted and cooperative solution.

A number of studies by the Council on Library and Information resources (CLIR)[4] have underscored the magnitude of the audio holdings in nearly every library and highlighted the problem that many of the carriers were fragile. They noted that, "The preservation of recorded sound collections entails a set of processes requiring careful planning and a sophisticated technical infrastructure."

To answer this growing concern, the U.S. Congress passed *The National Recording Preservation Act of 2000 (Public Law 106-474),* which established the need for national investigation of the issues related to preservation and access to sound recordings. This resulted in the 2010 national audio preservation study, *The State of Recorded Sound Preservation in the United States,* published by CLIR and the Library of Congress.[5] This study states that "over time it became clear to the recorded sound community that an array of obstacles faced by institutions and individuals dedicated to preserving historic sound recordings had become a serious national problem."[6] It further reports that "public institutions, libraries, and archives hold an estimated 46 million recordings, but few institutions know the full extent of their holdings or their physical condition.... Few institutions have the facilities, playback hardware, and staff resources to preserve recordings."[7] This report pointed to the Indiana University Media Preservation Survey, commenting that, "The careful and thorough design and scope of the IU study might serve as a model for other institutions."[8] Today, national task forces that include IU Bloomington staff are working on plans for tackling the audio legacy of the United States.

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[3] See www.firstsounds.org.
[4] Abby Smith, Davie Randal Allen, and Karen Allen, *Survey of the State of Audio Collections in Academic Libraries* (Washington, D.C.: Council on Library and Library Information Resources, 2004), http://www.clir.org/pubs/reports/pub128.pdf; *Folk Heritage Collections in Crisis* (Washington, D.C.: Council on Library and Library Information Resources, 2001), http://www.clir.org/pubs/reports/pub96/contents.html.
[5] Rob Bamberger and Sam Brylawski, *The State of Recorded Sound Preservation in the United States: A National Legacy at Risk in the Digital Age* (Washington, D.C.: Council on Library and Information Resources and The Library of Congress, 2010), http://www.clir.org/pubs/reports/pub148/pub148.pdf, accessed July 1, 2011.
[6] Bamberger and Brylawski, *State,* vi.
[7] Bamberger and Brylawski, *State,* 3-4.
[8] Bamberger and Brylawski, *State,* 12.

In the area of motion picture film, a national study culminated in *Film Preservation 1993*, a report of the Library of Congress, followed by publication of *Redefining Film Preservation*, a national plan that explored preservation and access issues and made recommendations. These reports remain relevant today and are often cited.[9] According to the 1993 film preservation study, "the battle for their preservation is being lost.... Films of all types are deteriorating faster than archives can preserve them."[10] *The Film Preservation Guide* summarizes the current best practices for preservation and access of film. The work was developed by a collection professionals who were creating film preservation programs.[11]

Another Library of Congress national study published in 1997 addressed the preservation of the country's television heritage particularly as carried on videotape.[12] It finds the American heritage "at risk.... [V]ideotape vulnerability to deterioration further imperils this rich heritage, and additional videotape recordings may be lost to posterity if archival programs do not address format obsolescence."[13] Standards and best practices for video preservation are evolving more slowly than audio but there is a major new initiative underway within the International Association for Sound and Audiovisual Archives along with new development work undertaken by the Federal Agencies Digitization Guidelines Initiative in the United States. One important earlier research project completed by the Dance Heritage Coalition addresses important issues associated with digital preservation of video.[14]

Preservation in the digital domain has also been the subject of a number of studies and much research. For example, the Blue Ribbon Task Force on Sustainable Digital Preservation and Access noted that there are "three imperatives for sustainable digital preservation:"

- Articulate a compelling value proposition
- Provide clear incentives to preserve in the public interest
- Define roles and responsibilities among stakeholders to ensure an ongoing and efficient flow of resources to preservation throughout the digital life cycle[15]

Very few facilities are in place to accomplish media preservation work. The preeminent facility in the world is the National Audio-Visual Conservation Center of the Library of Congress located in Culpeper, Virginia, in the eastern part of the United States. Built by the David and Lucille Packard Foundation and the Packard Humanities Institute at a cost of nearly $200 million and then donated to the Library of Congress in 2007, the facility is the state of the art in media preservation. The Media Preservation Working Group visited this facility and consulted with the staff over a period of several days. We also conducted joint seminars during this period on potential solutions to specific preservation issues.

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[9] Annette Melville and Scott Simmon, *Film Preservation 1993: A Study of the Current State of American Film Preservation* (Washington, D.C.: National Film Preservation Board of the Library of Congress, 1993); *Redefining Film Preservation: A National Plan*, coordinated by Annette Melville and Scott Simmon (Washington, D.C.: National Film Preservation Board of the Library of Congress, 1994); both available at http://www.loc.gov/film/filmpres.html.

[10] *Film Preservation 1993*, Volume 1: Report, accessed June 1, 2011.

[11] *The Film Preservation Guide: The Basics for Archives, Libraries, and Museums* (San Francisco: National Film Preservation Foundation, 2004).

[12] William Thomas Murphy, *Television and Video Preservation 1997: A Report on the Current State of American Television and Video Preservation* (Washington, D.C.: Library of Congress, 1997), http://www.loc.gov/film/filmpres.html.

[13] Murphy, *Television and Video,* accessed June 1, 2011.

[14] *Digital Video Preservation Reformatting Project* (Washington, D.C.: Dance Heritage Coalition, 2004), http://www.danceheritage.org/preservation/Digital_Video_Preservation_Report.doc.

[15] *Sustainable Economics for a Digital Planet: Ensuring Long-Term Access to Digital Information* (Washington, D.C.: Blue Ribbon Task Force on Sustainable Digital Preservation and Access, 2010), http://brtf.sdsc.edu/biblio/BRTF_Final_Report.pdf.

Several members of the Indiana University working group also visited film preservation facilities in the western part of the United States, particularly at UCLA, where another David Packard-funded facility is being constructed for their well-known film collections. A $39 million nitrate film vault has been completed, with construction of the larger preservation facility to begin soon. There is nothing to match these bicoastal facilities, however, in the central part of the United States. This is where opportunity for Indiana University resides. We can address not only our own preservation challenges but also cooperate with other institutions within the Midwest region and beyond.

There is nothing to match these bicoastal facilities, however, in the central part of the United States. This is where opportunity for Indiana University resides.

Summary of Media Preservation at CIC Institutions

The media preservation landscape at other institutions within the CIC[16] is challenging to assess. No other institution has yet completed a census of its time-based audiovisual media comparable to that undertaken at IU Bloomington, although one is currently underway at the University of Illinois, and some other institutions have undertaken more narrowly focused censuses in the past. Task Force research has documented more than 1.5 million audio, video, and film objects held by CIC institutions, *not* counting Indiana University. With IU Bloomington, the total is over 2 million. A breakdown by media type yields the following in rough numbers, again without IU:

- More than 1,039,000 audio recordings (1,404,000 with IU)
- More than 300,000 video recordings (425,000 with IU)
- More than 110,000 film objects (190,000 with IU)

Task Force research also explored digitization programs and efforts on each CIC campus. There are only a very few facilities at CIC institutions that approach or attain a preservation level of work, and these are typically unavailable to other campus units, due to a combination of policy and capacity limitations. They operate on a small and narrow scale. Nowhere did research uncover any center attached to a CIC university that offers preservation-level digitization of time-based audiovisual material to any and all campus units who need it.

Strategic Planning at IU

Indiana University is clearly not alone in its concern for its media holdings, but it has taken the most comprehensive steps thus far towards assessing the scope of the challenge and planning a solution. The international attention the survey has received is indicative of its importance and the necessity for more work like it around the world. This work has been imperative at IU given the size and diversity of the university's holdings, but support for the underlying value of this project permeates many other visions of IU's future and the strategic

[16] The Committee on Institutional Cooperation (CIC) is a consortium of the Big Ten universities plus the University of Chicago.

plans created to address them. The Media Preservation Initiative dovetails with a number of strategic initiatives on the Bloomington campus.

The Principles of Excellence

In his 2010 State of the University address, IU President Michael McRobbie outlined core "Principles of Excellence." Specifically, media preservation efforts relate to the third principle, Excellence in Research:

- Maximize IU's full capacity for research, scholarship, and creative activity that is recognized as excellent through national and international peer comparisons

Preserving and digitizing this massive set of intellectual data will exponentially increase information that will be available to researchers not only at IU but around the world. New kinds of projects and studies will be possible with this work with time-based capabilities not yet addressed in other projects such as Google Books.

The initiative also addresses the ninth principle, The Centrality of Information:

- Ensure that the Principles of Excellence are supported by outstanding information technology and information resources

This Media Preservation Initiative will make a substantial body of resources accessible through the Indiana University's cyberinfrastructure and provide access in substantially new ways, demonstrating the power of such a system to dramatically change research possibilities. In creating the Indiana Media Preservation and Access Center, we will centralize resources—resources that will otherwise disappear in a relatively short period of time—and put them at the disposal of our own faculty and students, as well as the rest of the world.

Office of the Vice Provost for Research Five-Year Strategic Plan 2008-2013

The Media Preservation Initiative fits well with Priority 3 of IU Bloomington's OVPR plan to "cultivate and expand research initiatives related to IU Bloomington's special collections and research facilities." One specific strategy related to this priority resonates with the Media Preservation Initiative:

- Initiate a campus-wide effort to assess special collections, promote discussion among holders of the collections, and develop a comprehensive view of what is required to properly preserve the materials

Planning with the special collections in close collaboration with the IU Libraries began in 2008. Specific plans being developed for consolidation and cooperation between a number of the units will be made possible by the creation of the Indiana Media Preservation and Access Center.

Empowering People: Indiana University's Strategic Plan for Information Technology 2009

The most recent Indiana University information technology strategic plan describes in considerable detail the outlines of our proposed Indiana Media Preservation and Access Center in Action 37:[17]

- IU should provision a full-featured and robust multimedia utility service to digitize (if needed) and preserve film, audio, and complete creative works. The utility should enable abundant near- and long-term storage, presentation in variety of individual or group settings, and permissions and rights management, and should provide search and retrieval for whole and partial clips based on terms or associations.

This "utility service" will provide a unique opportunity to preserve and access a vast store of legacy data. Even more important, it will allow future generations of scholars and students to capture, edit, and access important aspects of the cultural heritage of the world.

Indeed, Indiana University's *International Strategic Plan*[18] outlines interdisciplinary collaboration, calling for "substantial online electronic resources relating to the field of study." The Media Preservation Initiative will provide such resources to a host of fields of intellectual inquiry and make them ubiquitously accessible in many parts of the globe.

IU Libraries: Mission

The mission and action plan of the Indiana University Libraries articulates several goals that are closely related to the work of the Indiana Media Preservation and Access Center.

Goal 1.4 **Preserve both analog and digital resources.** *Ensure long-term access to the IU Libraries' collections through archiving, storage, and preservation efforts.*

Goal 1.5 **Ensure a sustainable technology infrastructure**. *Invest in additional resources to sustain and improves the IU Libraries' computing infrastructure in order to provide users seamless, integrated access to digital collections.*

Goal 1.6 **Transform physical spaces within the IU Libraries**. *Place library users at the center of library planning and proved physical spaces that better support and respond to their academic needs.*

Goal 3.4 **Identify, develop, and expand partnerships**. *Establish mutually beneficial partnerships that result in cost savings as well as worthwhile, discernible outcomes.*

As the work of the libraries adapts to new technologies, the Media Preservation Initiative dovetails with several key goals that have been articulated.

[17] *Empowering People: Indiana University's Strategic Plan for Information Technology, 2009*, 27. http://ep.iu.edu/.
[18] *International Strategic Plan* (Bloomington: Indiana University International Program, 2008), http://www.indiana.edu/~ovpia/ovpia/strategic/International%20Strategic%20Plan%202008.pdf.

4 Preservation Planning

Overview

A major component of Task Force work involved researching, analyzing, and addressing issues critical to the long-term preservation of campus media holdings. Preservation planning began with an analysis of the window of opportunity available to digitally preserve IU Bloomington's media holdings, which compelled the Task Force to specify a fifteen-year time frame to complete this work. Next, we articulated a set of principles to guide campus preservation work and then began analyzing the work itself. An examination of the steps in the preservation process confirmed that IU Bloomington must build media preservation infrastructure regardless of whether digitization is tackled in-house or outsourced. Evaluating the advantages and disadvantages of building in-house digitization capabilities versus outsourcing resulted in the identification of a set of factors unique to IU Bloomington that make a powerful case for building.

A deeper analysis of preservation workflow options then forced the Task Force to define where the intersection of preservation principles and time pressures (as realized in more, or less, efficient workflows) lies for our institution. The key product of this analysis was construction of the "Indiana University Approach" to preservation transfer work that maintains preservation principles within a high efficiency workflow. Because campus holdings are very large and time pressures great, even high efficiency workflows may not preserve everything in time. Nor do we believe that every recording is an appropriate candidate for long-term preservation. For these reasons, the Task Force worked with campus stakeholders to define a structured process for prioritizing media collections by research value as well as preservation condition in collaboration with curatorial staff. Some parts of prioritization work, along with other media preservation tasks, will be supported by graduate students. This is the result of yet another analysis that looked at opportunities for educating and training students. Finally, the Task Force collaborated with Radio and Television Services on a video preservation pilot project to gain additional experience with archival video.

Details of all of the activities outlined above are presented in the following pages.

Window of Opportunity

Key Points

Analysis of degradation in campus collections and rapidly advancing format obsolescence, as well as consultation with leaders in the field, compel the Task Force to define a fifteen-year target to digitally preserve audio and video holdings.

The Task Force has created a set of guiding preservation principles in the general areas listed below to use in developing recommended preservation strategies, infrastructure, and implementations:

- A long time horizon must frame all decisions.
- Timely decisions must be made to combat obsolescence and degradation of formats and collections.

- Digitize once—it will not be feasible a second time.
- Preservation digital files must reflect faithful reproduction, accuracy, and integrity.
- Ongoing preservation is required, not just one-time digitization.
- Use international standards and best practices where they exist.
- Preservation and access must not compromise each other.
- Leverage existing IU resources.
- Build strong partnerships.
- Long-term preservation, access, and management decisions reside with curatorial and unit staff.
- Transparency to stakeholders.
- Prioritization before preservation.
- High-efficiency workflows are needed to meet targets.

Media archives have reached a critical point in their history marked by the simultaneous deterioration of unique original materials, the development of powerful new digital technologies, and the consequent decline of analog formats and media. Rapidly advancing obsolescence—of playback machines, spare parts, technical expertise, tools, and formats—combined with degradation of carriers multiplied by large numbers of archival recordings have resulted in a necessary race against time to preserve important holdings. It is now clear to audio and video archivists that old analog-based preservation methods are no longer viable, and new strategies must be developed in the digital domain. Many archivists believe that this generation's primary task is to digitally preserve audio and video holdings for long-term preservation and increased access before it is too late. In fact, it is now widely thought that a fifteen- to twenty-year window of opportunity exists—even less for some formats—before the combination of degradation, obsolescence, and large numbers makes it either impossible or prohibitively expensive to do this work.

Preservation issues for motion picture film have also reached a crisis point although intervention strategies are somewhat different. Long-term preservation currently relies upon cold storage as the single most important factor. Access for research, however, increasingly depends upon digitization. While some specific research needs require direct use of film, most research agendas are more easily served by the use of digital objects. The window of opportunity to digitally preserve audio and video holdings may also be considered a strategic opportunity to revolutionize the research use of film through access digitization.

The window of opportunity to preserve born digital media content may be even smaller. Born digital media files must be actively managed to remain viable over time. Failure to undertake preservation-related action over as short a period as five years may result in data that can no longer be fully accessed or interpreted.

The holdings of Indiana University Bloomington as detailed in its media preservation survey report provide a strong case-in-point. The campus owns more than 560,000 audio, video, and film objects on

Indiana University Bloomington owns more than 560,000 audio, video, and film objects on more than fifty different formats housed in eighty units. An estimated 44 percent of these items are unique or rare.

more than fifty different formats housed in eighty units. An estimated 44 percent of these items are unique or rare. Degradation is evident and includes delaminating lacquer discs, error-filled Digital Audio Tape (DAT) and MiniDV playback, Sticky Shed Syndrome open-reel tapes, Vinegar Syndrome films, shedding ½-inch open-reel videotapes, sticking audiocassettes, and drop-out filled U-matic videotapes. Each format requires its own playback machine(s), spare parts, and technical playback expertise to obtain an optimal playback for preservation transfer. All of these are increasingly in short supply. In addition, there are already large numbers of born digital recordings in campus holdings, and this media type will dominate in the future as collections grow. Most of these are not managed for long-term preservation or access. Preservation of the content on media recordings at Indiana University Bloomington, as at many other institutions, is now urgent. No longer can archival media holdings be kept passively on a shelf or unmanaged in storage with any expectation that they will survive.

Defining a maximum fifteen- to twenty-year window of opportunity necessarily involves a subjective projection into the future. Given the scale of the challenge, does it matter if this estimate is off by five years or even ten years? Consider the following evidence of degradation in campus holdings as well as current known format-based obsolescence factors:

Figure 1: Degradation in IU Bloomington Collections

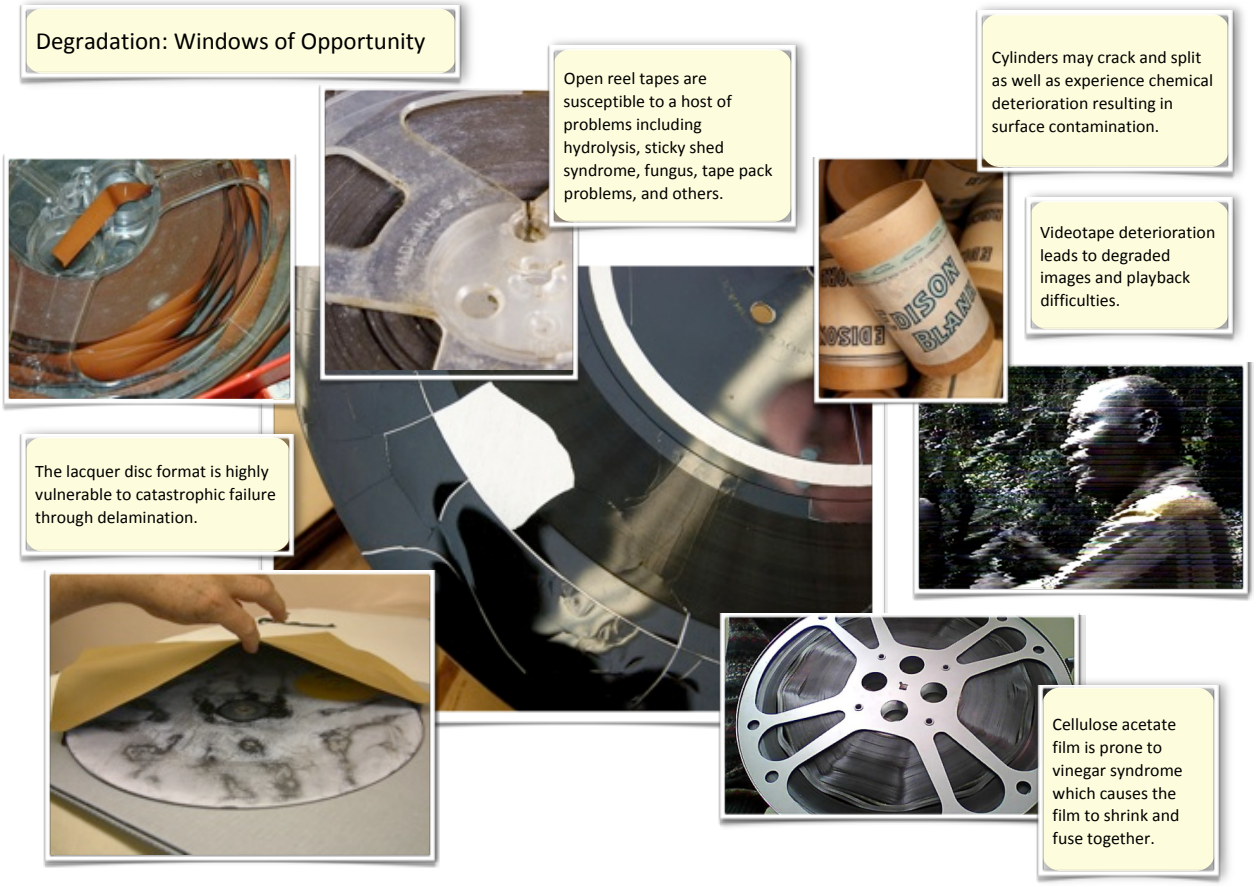
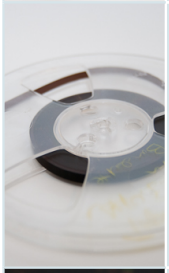
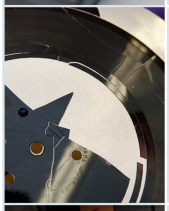


Figure 2: Obsolescence Issues in Audio and Video Formats

Format	Name	Obsolescence Notes
	Audio Cassette	• No alignment/calibration tapes. • No professional machines manufactured.
	Open Reel Tape	• One semi-professional machine manufactured in very limited quantities. • Alignment tapes made by only one company. • Very limited supplies (boxes, flanges, splicing tape, etc.) • Parts and repair expertise very limited. • Bench technician tools scarce. • Manufacture of tape a 'boutique' industry.
	DAT	• Manufacturing of machines ceased 2005. • Small pool of used machines. • Existing machines used heavily in professional settings and have little head life. • Difficult to repair—few repair technicians. • Support and parts scarce for many models
	Lacquer and Aluminum Discs	• Requires custom styli made by one company • Requires professional turntable for large disks and a range of playback speeds--these are no longer manufactured. • Supplies limited.
	VHS Tape	• Professional machines no longer manufactured. • Tape cleaners (used in preservation work) made by two companies.
	MiniDV/DVCam	• Challenging to repair. • Format not yet obsolete but industry transition to tapeless and HD formats means obsolescence soon.
	Betacam SP	• Manufacturing of machines ceased 2001. • Some parts must be obtained from Japan.

Format	Name	Obsolescence Notes
	Umatic 3/4" Cassette	• Manufacturing of machines ceased mid-90s. • Only one small company rebuilds playback heads. • Many parts listed as 'not available' by Sony.
	1/2" Open Reel Videotape	• Format is long obsolete. • Machines and media no longer made. • Machines in good condition are rare. All need serviced. • Repair expertise scarce. • Parts and bench technician supplies no longer sold. • Multiple playback machines required to deal with interoperability issues.
	1" Open Reel Videotape	• Playback machines, parts, repair expertise, and playback expertise scarce. • Many parts no longer available.
	2" Quad Open Reel Videotape	• Obsolete for more than 25 years. • Playback challenges related to interoperability even when new. • Machines, parts, playback expertise very scarce. • Only one small company rebuilds playback heads. • Major loss of knowledge related to format.
	Hi-8	• Few professional playback machines manufactured (primarily camcorders). • No new recordings in the format

Given this evidence, it is clear that preservation action on media holdings is urgent if content is to survive. This action must be undertaken in the near-term, whether this is defined as five, ten, or fifteen years.

Guiding Preservation Principles

As the above analysis makes clear, the time in which preservation action for media holdings is both possible and feasible is short. It is also clear that while campus holdings are quite large, resources are finite. For these reasons, a set of general principles is needed to guide the development and implementation of preservation strategies so that efficient, accurate, sustainable, and enduring work is supported as well as cooperation between stakeholders, all while maintaining a consistent focus on the primary goal of long-term preservation.

Below is a set of general guiding principles that the Media Preservation Task Force is using to develop recommended preservation strategies, infrastructure, and implementations. We

recommend that these principles also be adopted by the campus as this project moves beyond the planning phase.

Preservation Principle 1: Long Time Horizon

All preservation-related decisions will take into account not just the short- and medium-term, but also long-term implications and consequences.

Although difficult and inherently inexact, it is necessary to anticipate the impact of our decisions not just five or ten years from now, but thirty to fifty years into the future.

Principle 2: Timeliness

All preservation-related decisions will take into account the need for timely preservation intervention. This may require, among other things, an analysis of degradation, obsolescence, and storage conditions specific to any given format or collection.

The opportunity to preserve some media objects that are actively degrading or carried on formats experiencing rapid obsolescence may be lost if preservation is not undertaken in the near-term. For example, the following formats—lacquer discs, Digital Audio Tapes, U-matic videotapes, and others—must be preserved very soon.

Principle 3: Digitize Once

The cost of preservation transfer, the large number of media objects that require preservation intervention, and issues related to degradation and obsolescence preclude returning to source recordings a second time for preservation transfer. Preservation-related decisions will support a "digitize once" philosophy that strives to make the current effort the last playback of the media object.

Workflows that produce lower fidelity copies may not support all future research use cases. In this situation, it may become necessary, although highly undesirable, to undertake preservation transfer a second time in order to produce suitable digital objects for long-term access. Note that for film holdings, digitization is not currently recommended for long-term preservation although it is often required for access and clearly supports efforts to preserve content over time. For this reason, it may be necessary to treat any given film more than once in its remaining lifetime.

Principle 4: Faithful Reproduction, Accuracy, and Integrity

A primary goal of preservation workflows is to produce digital objects that represent source recordings as faithfully, accurately, and with as much integrity as possible for use by researchers into the future. Preservation-related decisions will consider the implications of concepts such as faithful reproduction, accuracy, integrity, and completeness.

Choices of analog-to-digital converter, sample rate, bit depth, and playback techniques all may have great impact on the accuracy of the conversion to the digital domain. Choices relating to metadata collection may affect the integrity of the digital representation of source recordings. Business rules governing the creation of both preservation master files and production master files have an impact on the accuracy, integrity, and completeness of the digital representation of source recordings.

Principle 5: Ongoing Preservation

Long-term preservation is not a one-time endeavor but an ongoing set of strategies applied throughout a preservation system. The system must be fully functional in a number of areas including selection and appraisal, physical and intellectual control, preservation transfer (digitization), quality control, long-term storage, future migration, and regular data integrity checks.

Principle 6: Standards and Best Practices

All preservation-related decisions, services, workflows, and procedures will adhere to internationally recognized media preservation, digital preservation, metadata, and data curation standards and best practices in areas where they exist.

Use of international standards and best practices help ensure that preservation work is high quality, sustainable, and interoperable. In addition, they provide an ethical foundation upon which to make preservation decisions as well as encourage choices that support future migration paths.

Principle 7: Preservation and Access

Providing access to a media object must never endanger its long-term preservation. At the same time, preserving a media object must not compromise future access and usability.

It is possible to damage a media object during playback, particularly for some formats and/or if attempted by inexperienced staff, thereby compromising future playback efforts undertaken as part of preservation treatment. It is also possible to transfer a media object to a format that makes long-term access more difficult as well as fail to collect metadata necessary for future usability. Using experienced personnel and following standards and best practices mitigates both of these risks.

Principle 8: Leverage Existing Resources

Recommendations and plans developed by the Task Force will leverage existing Indiana University resources—including personnel, expertise, hardware, software, infrastructure, and strategic planning—wherever they exist. Duplication of resources or services will be avoided.

Indiana University Bloomington employs faculty and staff with considerable media preservation expertise and experience; applicable software for media preservation is in development at the university through various grant projects; the IT unit—UITS—has placed a mass storage system (Scholarly Data Archive, formerly MDSS) in service. These resources, and much more, will be integral to the final plan.

Principle 9: Partnerships

Successful preservation will require strong partnerships with campus units, other university stakeholders, and key organizations outside of Indiana University. Appropriate stakeholders will be identified and given the opportunity to contribute to the preservation plan as well as assume appropriate responsibility within their areas of expertise and/or curatorship.

Principle 10: Curatorial and Unit Responsibility

Indiana University Bloomington unit curators and other staff are ultimately responsible for the long-term preservation, access, and management of the media holdings in their custody. Decisions in these

areas will be made either by or in close consultation with curatorial staff. Units will remain responsible for some parts of an archival workflow for their own holdings regardless of the long-term plan that is developed. Some units will have the resources to handle more than others—solutions will be proposed for units with few resources in this area.

Principle 11: Transparency

Stakeholders will have access to the rationale, data, and strategic thinking behind preservation-related decisions and will be provided the opportunity to contribute to this work.

For example, we will provide access to the tools and data used to assess the research value of media collections.

Principle 12: Prioritization

Some holdings may be judged inappropriate candidates for long-term preservation. In addition, the forces of degradation, obsolescence, and cost may make it impossible to preserve all appropriate candidates given the size of campus holdings. For these reasons it is necessary to identify priorities for preservation treatment.

All selection for preservation decisions will include an analysis of issues related to degradation risk, current condition, format obsolescence, and research value. This analysis will be undertaken in partnership with Indiana University Bloomington unit curatorial staff. Curators may add additional variables for consideration in this selection process.

Principle 13: Efficiency

Due to the large number of media objects that require preservation treatment and the limited window of opportunity available as described above, it is imperative to develop highly efficient workflows to enable successful preservation of campus holdings in time and within available resources.

While the development of efficient workflows must engage international standards and best practices, they may also take into account the overall value of specific holdings as determined in the prioritization process. For content requiring less intervention or considered of lower value, high efficiency workflows may be considered, as appropriate.

Task Force Recommendations

1. Preserve audio and video holdings within fifteen years to combat the threat presented by ongoing degradation and rapidly advancing obsolescence.
2. Use preservation principles developed by the Task Force to provide sound guidance for preservation-related decisions.

Stages of Preservation for Media Objects

Key Points

Media preservation involves much more than digitization. It requires a number of both pre- and post-digitization steps for long-term success.

IU Bloomington must develop significant media preservation infrastructure regardless of whether the digitization stage is handled in-house or outsourced.

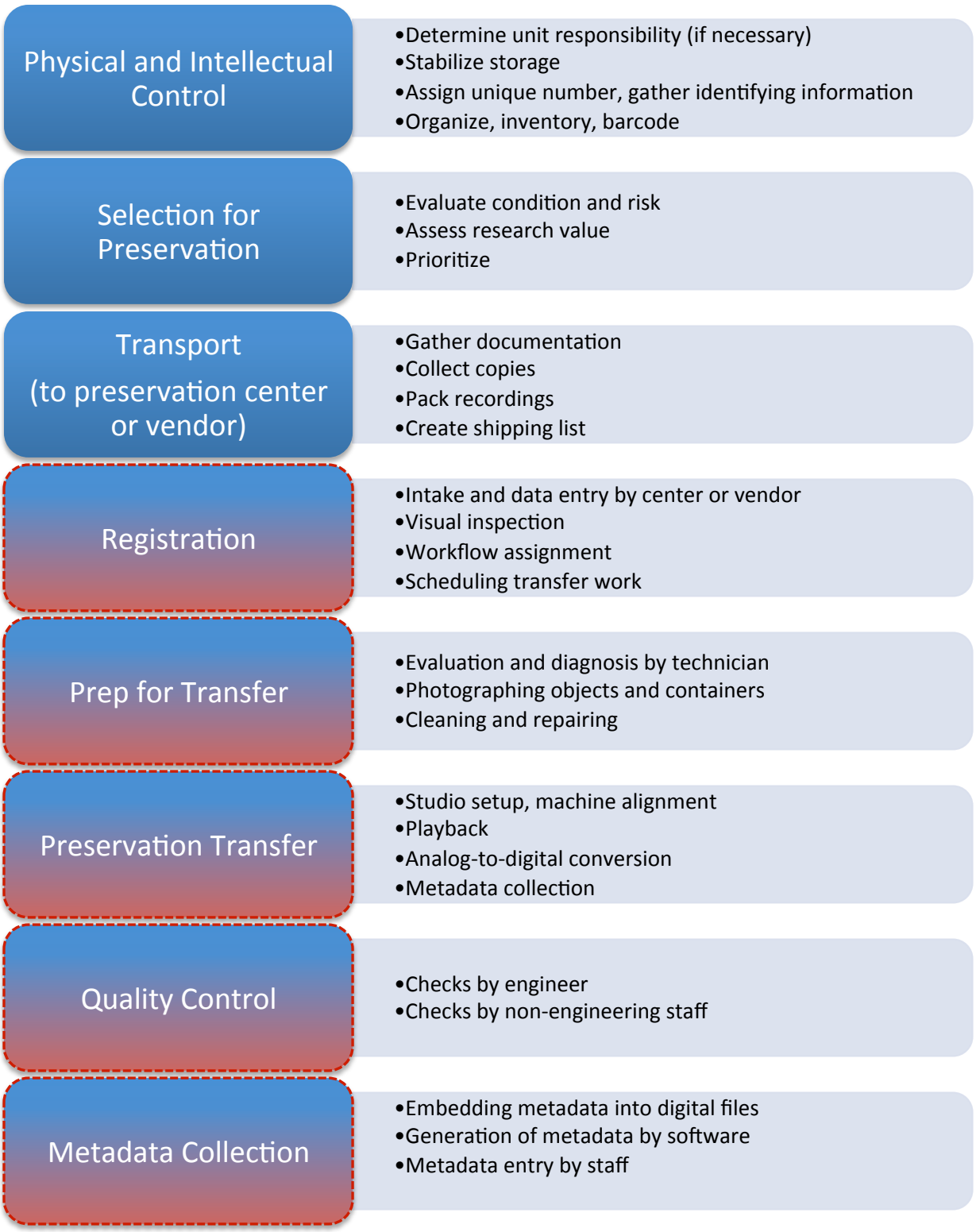
Audio and video preservation involves much more than simple digitization. It is relatively easy to digitize an open-reel tape, for example, using consumer-grade playback machines that have not been calibrated while making incorrect choices for such things as tape-track configuration or azimuth alignment and employing whatever file format is handy. Although in some settings this is all that resources may allow, this approach often results in digital files with severely diminished fidelity or demonstrable inaccuracies. What might better be called preservation transfer work, on the other hand, utilizes experienced engineers and/or technicians to ensure things such as optimal playback of deteriorating recordings on obsolete formats, verification of the signal chain including analog-to-digital conversion, accurate collection of technical metadata, and safe handling of fragile and deteriorating recordings. This yields manageable preservation master files with the best possible fidelity to accurately represent target content for any type of research use into the future.

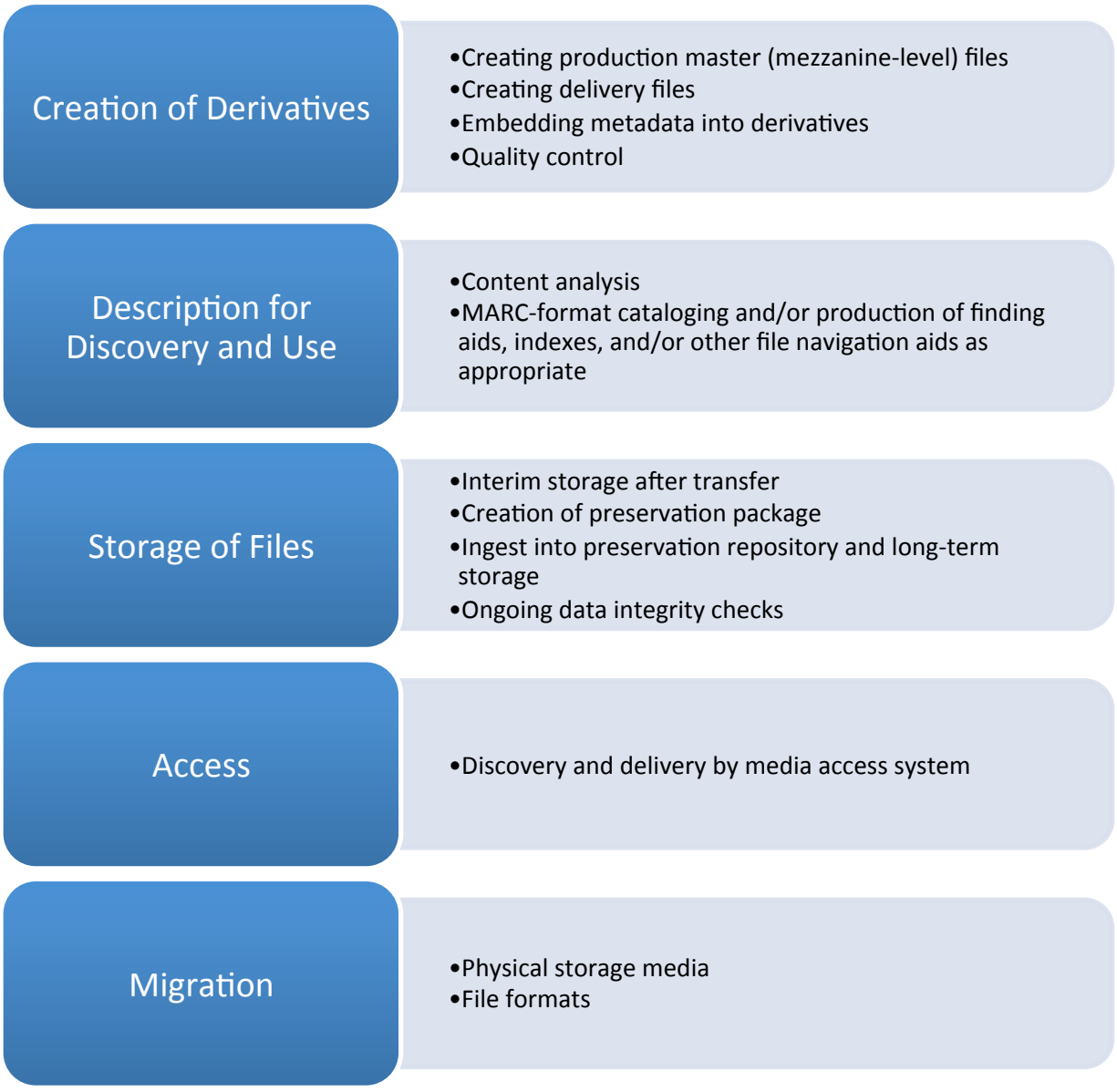
In addition, for preserved content to persist it must be discoverable, understandable, interpretable, and manageable over time. Achieving this requires successful completion of a series of activities including secure storage of both physical and digital assets, gaining intellectual control over the content, collecting and embedding metadata, quality control of completed work, use of international standards and best practices, ongoing migration of carriers and formats, and more. For our purposes, it may be more accurate to speak of "digitally preserving" rather than "digitizing" audio and video recordings to reflect the many stages of preservation that take place pre-and post-digitization.

Figure 3 below presents a high-level view of preservation stages for IU Bloomington media holdings. Note that this figure is not comprehensive or precisely detailed, and stages may overlap or vary in order depending on specific workflows. This model begins at the point where a media preservation center would engage in the preservation process and does not include general archival tasks such as the provision of suitable physical storage. Also note that this is just one model and is not the only way in which successful preservation may be achieved.

Activities related specifically to preservation transfer are shaded partly in red and marked with red dashed lines to bring focus to the other necessary steps in the process, both pre- and post-digitization. These non-digitization steps require infrastructure, and it is clear to the Task Force that whether preservation transfer is handled by an in-house facility or outsourced to a vendor, IU Bloomington must develop significant preservation infrastructure if it is to successfully preserve its media holdings.

Figure 3: Preservation Stages for IU Bloomington Media Holdings




Creation of Derivatives
•Creating production master (mezzanine-level) files
•Creating delivery files
•Embedding metadata into derivatives
•Quality control
Description for Discovery and Use
•Content analysis
•MARC-format cataloging and/or production of finding aids, indexes, and/or other file navigation aids as appropriate
Storage of Files
•Interim storage after transfer
•Creation of preservation package
•Ingest into preservation repository and long-term storage
•Ongoing data integrity checks
Access
•Discovery and delivery by media access system
Migration
•Physical storage media
•File formats

In-house vs. Outsourcing Preservation Transfer Work

Key Points

Factors that make the argument for building in-house digitization capabilities compelling include:

- Building in-house infrastructure and capabilities will cost less than outsourcing.
- Holdings are large and non-uniform and campus standards are high. These pose significant and possibly unworkable challenges to vendors.
- Quality control is a common problem for outsourced projects. It is more efficient and controllable when digitization is in-house.
- Campus builds from existing strengths. Newly gained expertise will reside on campus rather than with a vendor.
- There are many opportunities to educate and train students in a field in which few possibilities for training exist.
- IU Bloomington has a key strategic opportunity to assume national leadership in media preservation.

After examining the steps necessary to ensure long-term preservation, the Task Force undertook an analysis of the advantages and disadvantages of building in-house capabilities versus outsourcing preservation work. This analysis focused on preservation transfer (digitization), which is the preservation step most commonly outsourced. To successfully preserve its media holdings, IU Bloomington must build infrastructure that supports preservation and access functions such as selection and prioritization for preservation transfer, organization of materials for digitization, quality control of digitization products, cataloging and development of finding aids, creation of preservation packages, ingest into a preservation repository, long-term storage, ongoing data integrity checking, migration to new formats and carriers, and provision of access to researchers, among others. Adding preservation transfer to this list, while a major step requiring significant resources, represents in some ways just another step in this series of related and necessary activities. The Task Force has identified from its research a number of factors specific to IU Bloomington that make the argument for building in-house preservation transfer capabilities compelling. These are presented below.

Scale and Uniformity

IU Bloomington holdings are so large that commitment from a vendor or vendors would need to be considerable, extensive, and for a very long period of time. It is challenging to identify experienced vendors who could successfully enter into a commitment on this scale. IU Bloomington holdings are also largely heterogeneous in nature. That is, significant portions display relatively little similarity in format, recording, and other technical characteristics. This is particularly true in units that are considered research archives, holding unique and rare materials recorded by a wide range of scholars with varying technical abilities. There are exceptions, such as the holdings of Radio and Television Services, a technically skilled unit whose output is more homogeneous as is characteristic of a broadcast archive. In general, non-uniform materials such as many of those held in Bloomington present more challenges

for digitization in terms of the time, expertise, quality control, metadata, and costs that are required. They are widely seen as more difficult to outsource.

Quality Control

IU Bloomington is preservation-focused and has considerable experience in media preservation. The institution's stakeholders have specific requirements for media preservation work as well as clear ideas on how it should be accomplished based in part on their national leadership in this area. Undertaking work in-house affords us control over its ultimate quality. In its meeting last year, the Media Preservation Initiative's external advisory board pointed repeatedly to common problems with quality control that they had experienced with outsourced projects in their respective institutions. This corresponds with the experience of the IU Digital Library Program in outsourcing a number of digitization projects. Our conclusion is that even the best vendors may not be able to consistently meet quality expectations of experienced institutions. Also, we have uncovered philosophical differences in the implementation of standards and best practices with some vendors who perform work that we consider excellent.

Quality control is a necessary step in the preservation process whether digitization is undertaken in-house or outsourced. However, outsourcing results in a less efficient quality-control workflow at the institutional (the content holder) end as large batches of digitization products arrive at one time and must be checked. When work is completed in-house, quality control is routinely tackled shortly after digitization. In addition, one of the leading public stations in the United States—WGBH—reports that in their experience in-house work better supports descriptive practices, including cataloging, as transfer engineers can be trained to recognize and note data relevant to this function. They also report that outsourcing has proven difficult due to their rigid specifications for database information.

Expertise

IU Bloomington already possesses significant expertise in a number of areas critical to media preservation and access including audio preservation, film preservation, film presentation, digital libraries, networks, data storage systems, archival management, access systems, and others. Campus units also have significant experience developing programs and systems such as a preservation system (Sound Directions and EVIA projects), an access system (Variations and EVIA), a preservation repository (Digital Library Program), a massive data storage system (SDA), internationally used best practices for audio preservation (Sound Directions), and fast networks (UITS). All of these are key components, and all may be leveraged so that campus media preservation work builds from existing strengths.

IU Bloomington already possesses significant expertise in a number of areas critical to media preservation and access including audio preservation, film preservation, film presentation, digital libraries, networks, data storage systems, archival management, access systems, and others.

In addition, choosing to conduct preservation work in-house will enable the development of even deeper and more specific expertise, which will then reside within the institution rather than with a vendor. This expertise can benefit the non-digitization parts of the preservation workflow and also supports other arguments in this section, particularly related to quality control, education, and national leadership. The Task Force believes this will provide substantial advantages as the campus takes action to not only preserve current, but also newly acquired, content into the future.

Education

The focus of Media Preservation Initiative research is not just completing preservation work but also identifying opportunities for educating students and faculty. "Educating and Training Students in a Media Preservation Center" (page 53) explores areas in which students may receive training and experience in the proposed Indiana Media Preservation and Access Center (IMPAC). There is growing campus interest in media preservation as evidenced by the relatively large enrollment in the annual audio preservation course offered by the School of Library and Information Science (SLIS), the enthusiastic work of students during the recent processing of film holdings for the move to the Auxiliary Library Facility, and the ongoing work of ethnomusicology graduate assistants at the Archives of Traditional Music. SLIS has indicated interest in offering more courses in this area and possibly developing over time a media preservation track. Where else can students gain this training and experience? Both UCLA and NYU offer graduate degrees in moving image archiving but neither university is yet pursuing comprehensive preservation of its holdings or has developed an campus-wide media preservation center. There are only a few other opportunities in the United States, all of them limited. In addition, the Task Force recognizes educational and service opportunities for faculty holding media with archival value who have limited or no knowledge of preservation issues.

National Leadership

IU Bloomington has a significant opportunity to assume national leadership in this area. No other U.S. university has completed a preservation survey as detailed and comprehensive as ours, and none, to our knowledge, is yet developing a campus-wide media preservation plan. Others will inevitably follow as the available window for digitally preserving analog recordings begins to close and the need to provide preservation services for incoming born digital content becomes overwhelming. Some institutions will prefer to outsource digitization work rather than develop in-house capabilities due to the costs and/or expertise involved. With a media preservation center, IU Bloomington would be in a position to provide services to other institutions.

The issues are somewhat different for film as discussed in more detail below. Digitization of film serves access needs while appropriate storage guarantees long-term preservation. Relatively few film archives are engaged in the wholesale digitization of their holdings. In addition, there is only one other educational film collection currently available in the digital domain. IU Bloomington has an opportunity to lead in this area by making its film collections, particularly educational and documentary materials, readily accessible via digital files.

In a larger sense, few institutions currently provide digital access to media holdings on a large scale, although some are headed in this direction. If IU Bloomington is able to meet its targets—preservation and access to more than 400,000 media objects in fifteen years as discussed below—it would become an undisputed international leader.

Cost

A data-driven analysis conducted by project consultant AudioVisual Preservation Solutions (AVPS) and the Task Force concluded that it is significantly less expensive to preserve IU Bloomington media holdings in-house over the defined fifteen-year period than to outsource. This analysis included all projected costs associated with building, staffing, and operating the proposed IMPAC. On the outsourcing side, it included not only costs for digitization and prices for shipping media, but also costs associated with preparing items for digitization and performing quality control on returned digital files. Tables 1 and 2 below show the data points used in this projection. The bottom line of this analysis is that outsourcing digitization for all media holdings selected for preservation will cost 77 percent more than building the capabilities to transfer them ourselves.[19]

The largest and most variable expense in this analysis is the price charged by vendors for digitization services. Variations in this area have the most impact on the final cost. The information used in this analysis consisted of a large data set of pricing information gathered and maintained by AVPS. Overall relevancy was ensured by selecting current information representing similar size and nature to IU Bloomington holdings to the greatest extent possible across all formats. Quotes from a total of ten vendors that service the archives market were used throughout the analysis with high and low figures discarded before averaging the rest. There were typically five to six quotes available for any given format although there may be only two or three prices for more obscure formats as fewer vendors handle them. While these numbers are derived from a significant and relevant data set, it is expected that there is a reasonable margin of error based on variances in quantities, specifications, logistical considerations, and market conditions. However, even if there is a gross error (which we do not believe to be the case), and projected vendor costs are cut in half, our analysis demonstrates that it is still more cost-effective for IU Bloomington to build in-house digitization capabilities.

The tables below present data points for a comparison of the costs required to preserve campus holdings entirely in-house at IU Bloomington (including the digitization stage) versus a scenario where digitization is outsourced to a vendor with other stages completed in-house. This is not a budget proposal and does not include every cost associated with preservation. For example, we have not projected equipment replacement or added costs for a media processing server in this analysis. These will be included in a separate internal IU Bloomington budget document. Rather, we have constructed a fair comparison of preservation-related costs to inform decision making in this area.

[19] Note that this analysis is specific to the collections and institutional context at Indiana University Bloomington. It may or may not apply to other settings. For this reason, we have removed the costs from Tables 1 and 2 for this public version of the report.

Table 1: Data Points for In-house Analysis

In-house Data Points	Notes
Direct labor digitization	In-house technical staff handling digitization workflows
Pre/post staff	Pre- and post-digitization workflow
Equipment	All workflows including digitization
Equipment maintenance	Over 15 years
Supplemental outsourcing	Very difficult formats requiring highly specialized expertise
Shipping to vendor	For supplemental outsourcing
Facility build costs	Projected construction cost
Facility operation costs	Over 15 years with 5 percent increase each year
Administrative staff	IMPAC administration
Programming staff at Digital Library Program	Development of preservation repository and workflow tools
Misc. staff	Not included above in direct labor digitization
Repository (SDA) storage	Storage in Scholarly Data Archive over 15 years
Interim storage and networking	High density storage NAS and network upgrades over 15 years

Table 2: Data Points for Outsource Analysis

Outsource Data Points	Notes
Digitization	Vendor pricing data set (see discussion above)
Pre-dig staff at IU	Required even if digitization outsourced
Equipment at IU	Pre/post and QC workflows
Equipment maintenance at IU	Over 15 years
QC staff at IU	Quality control of digitization products
Shipping to vendor	
Programming staff at Digital Library Program	Development of preservation repository and workflow tools
Repository (SDA) storage	Storage in Scholarly Data Archive over 15 years
Interim storage and networking	High density storage NAS and network upgrades over 15 years

Task Force Recommendations

3. Build in-house digitization capabilities for most campus media formats to meet IU Bloomington goals and expectations, leverage existing resources and expertise, and reduce the cost of preservation.
4. Develop a media preservation track within the School of Library and Information Science.
5. Develop partnerships with other institutions, particularly within the CIC, that feature the provision of joint media preservation services.

The Indiana University Approach to Preservation Transfer

Key Points

Common digitization approaches include:

- 1:1 workflow where one engineer transfers one recording at a time.
- Mass migration parallel transfer workflow where one engineer transfers as many as sixteen or more recordings at a time. This high efficiency approach carries greater risk.

Mass migration is unacceptable to IU Bloomington due to serious preservation concerns.

1:1 transfers will take too long or require an unfeasible number of staff.

The Indiana Approach maintains preservation principles within a high-efficiency method by using a mix of 1:1 and smaller scale 2:1 and 4:1 parallel transfer workflows and by automating selected tasks. This approach addresses campus preservation concerns *and* completes the job in fifteen years.

Preservation transfer (digitization) workflows used by institutions for archival audio and video recordings vary widely depending on variables such as collection size and research value, institutional resources and philosophy, and the requirements of stakeholders. Workflow choices not only determine how long it takes to complete the job, but can also impact the integrity of the transfer process and the accuracy of the resulting file. For these reasons, and because resources to re-digitize are not likely to be available, it is critical to make careful and informed choices.

There are two basic ways to transfer audio and video content to digital files. The first uses a 1:1 (sometimes termed custom) workflow in which one engineer transfers one recording that is fully monitored (listened to or viewed) from beginning to end. The second employs a parallel (also called high throughput) transfer workflow in which one engineer supervises the digitization of more than one recording at the same time. The former is considered the "gold standard" for preservation transfer work and regarded as the only philosophically sound method by some practitioners. The latter carries greater risk but is used extensively by a wide range of institutions who believe that the available time for preservation work is shorter than they can manage due to active degradation of carriers and rapid obsolescence of formats, multiplied by very large numbers of recordings. In other words, existing or anticipated resources available to these institutions will not be sufficient to preserve holdings in time, leading them to choose parallel transfer workflows.

Workflow Implementations[20]

Parallel transfer workflows may be implemented at different scales, ranging from simply digitizing two recordings at once to transferring sixteen or more at a time. The higher end of this scale encompasses what are variously known as mass digitization (or mass migration) and large-scale digitization workflows. Mass digitization efforts are typically characterized by

- little or no advance selection work—nothing is assessed, nothing is prioritized, and everything is digitized;
- minimal intellectual control—enough description to match objects to digital files and no more;
- minimal collection of technical and digital provenance metadata, potentially limiting future management and use of preserved content;
- no setup or calibration of playback machines to match the characteristics of the recorded signal on individual tapes, potentially resulting in diminished fidelity;
- parallel transfer of relatively large numbers of recordings by one person resulting in very high throughput and more digitized items;
- little or no monitoring of the parallel transfer streams;
- little or no human quality control, although there may be automated quality control by software;
- use of robotics to handle tapes including loading them into playback machines.

Large-scale digitization shares with its mass digitization cousin the implementation of high throughput workflows (many recordings at a time) but may include other procedures such as advance prioritization or setup of playback machines.

At the other end of the parallel transfer scale, some institutions implement smaller versions of parallel workflows, typically digitizing on the order of two, three, or four items at once.[21] This lowers the risks described below by, for example, enabling significant monitoring of the parallel transfer streams. The photograph in Figure 4 illustrates a smaller parallel transfer workflow used in the NEH-funded Sound Directions project at IU Bloomington.

Figure 4: Parallel Transfer of Three Audiocassettes at the Archives of Traditional Music

[20] This section draws upon a document prepared for the Task Force by our consultant, Chris Lacinak of AudioVisual Preservation Solutions.

[21] For example, several Australian institutions who are leaders in the implementation of audio preservation workflows use this approach. This includes the National Library of Australia, the National Film and Sound Archive, and the Australian Institute for Aboriginal and Torres Strait Islander Studies.

In contrast, a 1:1 workflow as described above features one engineer and one recording, done one at a time with full monitoring from beginning to end. This type of workflow usually includes advance prioritization work, significant intellectual control, and the collection of a rich set of technical and digital provenance metadata, although it does not depend on these features. Figure 5 illustrates a typical 1:1 workflow.

Figure 5: Audio Engineer John Dawson Transfers an Aluminum Disc at the Archives of Traditional Music

Risks

Risk may be defined as the probability and magnitude of a loss, disaster, or other undesirable event.[22] Parallel transfer workflows are generally perceived as riskier than 1:1 workflows. The major risk is often articulated as follows: Something goes wrong that lessens the fidelity of the transfer, and the problem is missed by the attending engineer whose attention is divided among the simultaneous transfer streams. This results in digital files with either diminished fidelity or outright errors that, if not discovered during quality control, represent the preserved content into the future.

Some parallel transfer workflows, particularly those associated with a mass digitization approach, may be considered not only as riskier but also as requiring compromises. For example, if advance prioritization work is not completed, it is inevitable, for most collections, that some items with no or very low research value will be digitized, using precious resources. To aid decision making in this situation, it may be necessary to analyze the cost of digitizing everything versus the resources needed for prioritization work. Also, it is clear that without playback machine setup some, or possibly many, recordings will not be transferred optimally due to misalignment of the machine with the signal on tape.

Parallel transfer workflows were pioneered by broadcast archives whose collections tend to be both large and homogenous. For example, broadcast audio collections commonly consist of professional-quality open-reel tape recorded by professional staff using professional machines. The tapes contain test tones at the head of the tape for machine alignment. The contents are arranged on the recording (track configuration, recording speed, leader tape, use of silence) in largely predictable ways. The collection has been stored for many years in a known, reasonable environment. These types of collections lend themselves to parallel transfer workflows as they exhibit fewer problems, and their predictability makes risk mitigation easier. Archival research collections, on the other hand, are highly heterogeneous in nature, recorded by collectors of varying skill on a greater variety of tape stocks using consumer machines. Tapes are less predictable in such variables as track configuration and recording speed, sometimes changing mid-tape, and may have been stored in uncontrolled conditions. These types of collections present not only more variables to control, but more problems for preservation engineers to address.

[22] Douglas W. Hubbard, *The Failure of Risk Management: Why It's Broken and How to Fix It* (Hoboken, NJ: John Wiley & Sons, 2009), 10.

Mitigating the Risk: Sound Directions Research

In 2009–10, the internationally recognized Sound Directions project at Indiana University conducted research on parallel transfer workflows with funding from NEH. The primary goal of this research was to develop safe parallel transfer applications for archival audio research collections. Essentially, the work explored procedures to mitigate the perceived risks and obtain a high level of confidence that the output of a parallel transfer workflow is preservation-worthy. It focused on two points in a parallel workflow that were deemed particularly fertile for significant risk mitigation: the process of deciding whether an individual recording is a good candidate for parallel transfer and the monitoring of the transfers themselves.

Results of this research included the development of a selection or triage process that channels individual recordings to either a parallel transfer or 1:1 workflow as appropriate. This produces batches of similar items that are likely consistent, largely problem-free, and considered suitable for parallel transfer as well as identifying up front problematic recordings that require 1:1 attention.

The research also included the development of monitoring procedures that enabled

- listening to all parallel recordings at all times through the use of volume changes that bring individual items into and out of aural focus in rotation with smooth fades in between;
- physical co-location of playback machines and monitors that enables rapid identification of any recording if a problem is heard;
- use of red LED lights on playback machines to mark the recording currently in focus, again enabling rapid identification if there are problems;
- use of a QuickTime movie on a separate laptop to quickly identify the recording currently in focus;
- automated switching between recordings so that the engineer's attention is cued to move from one recording to the next at a predetermined interval.

Finally, Sound Directions research uncovered several areas in which parallel workflows potentially increase the accuracy of transfer work compared to the 1:1 "gold standard" For example, it is easy to detect shifts in fidelity or problems with a signal chain when multiple similar items are playing at the same time, if the engineer is monitoring each in turn. Therefore, if a tape is shedding, leading to gradual loss of high frequencies, it will be obvious in comparison to the other recordings. If only one recording is playing, the engineer is forced to rely on memory, which has been proven highly inaccurate for audio, to judge if a gradual fidelity shift has occurred compared to the last recording transferred.

The Indiana University Approach

Indiana University Bloomington has a long and rich history of collecting, producing, studying, preserving, and providing research access to media recordings. A number of units have made strong commitments to the accurate long-term preservation of their holdings and have much experience and technical expertise in this area. The Media Preservation Initiative Task Force's statement of preservation principles includes a "digitize once" philosophy, recognizing that "the large number of media objects that require preservation intervention, and issues related to degradation and obsolescence, preclude returning to source recordings a second time for preservation transfer." This statement also declares that "a primary goal of preservation workflows is to produce digital objects that represent source recordings as

faithfully, accurately, and with as much integrity as possible for use by researchers into the future."

Yet, the Task Force recognizes the obvious need for high throughput transfer workflows. We have defined above a fifteen- to twenty-year window of opportunity, chosen a fifteen-year target as discussed above, and designated some 350,000 audio and video recordings on campus in need of preservation transfer. Our data shows that if all of these recordings are digitized with a 1:1 workflow using the staff resources presented in our build plan below, it will take twice the time—thirty years—to complete this work. If we increase the staff to get digitization done within fifteen years using only a 1:1 workflow, we would need to hire double the audio and video engineers and technicians plus build a significantly larger facility and purchase more equipment.[23] Clearly, exclusive use of 1:1 workflows is not a realistic possibility if highly valuable content is to be digitally preserved affordably and in time.

We have defined a middle ground that addresses preservation concerns while utilizing higher-throughput workflows, placing a strong emphasis on maintaining preservation principles within a high-efficiency approach.

Although campus media content includes small broadcast collections as well as large commercial holdings, many of our recordings are part of large heterogeneous research archives. Given this, and the institution's commitment to high-quality preservation, the Task Force finds mass digitization workflows for media holdings inappropriate within our context. While adopting a mass digitization philosophy might enable the completion of work in a relatively short period of time, it comes with costs that we are unwilling to bear. These costs may be summarized as:

- great potential for damage to unique recordings due to lack of advance inspection, lack of engineer attention during transfer, and the fragility of some formats,
- creation of a substantial number of digital files with significant diminishment of fidelity or outright errors that become the only representation of preserved content for use by researchers into the future,
- minimal and, for us, inadequate metadata on the technical characteristics of the digitized recordings and the digitization process.

Instead, we have defined a middle ground that addresses preservation concerns while utilizing higher-throughput workflows, placing a strong emphasis on maintaining preservation principles within a high-efficiency approach. Our plan is to use a mix of smaller-scale 2:1 and 4:1 parallel transfer workflows when appropriate along with custom 1:1 work when necessary. The parallel workflows, for which we will employ a variety of risk mitigation procedures to address preservation issues, will greatly increase the output of products considered preservation-worthy within our context. This strategy, which addresses

[23] As described in the section on facility planning, we have developed detailed data on campus holdings, workflows for each format, and the time it takes to complete workflow tasks. This provides us with bottom-line data on the time and staff required to preserve any number of recordings using various types of workflows.

preservation needs *and* completes this work within the fifteen-year time window, features the following:

- A robust yet quick and efficient selection (triage) process that directs recordings to a parallel transfer or 1:1 workflow as appropriate to the format, condition, and research value of each item.
- Minimal descriptive metadata up front—just enough to support identification and tracking of objects through the workflow and matching of objects with digital files. Full description will be not only possible but easier and more accurate once digital files exist.
- Collection of a rich set of technical and digital provenance metadata using a software application that makes this process highly efficient.
- A preliminary transfer stage in which the first few recordings of a collection are digitized followed by an intensive round of quality control to catch problems early.
- Monitoring protocols, as described above, that make it not only possible but reasonable to listen to and/or view most of parallel-transferred content as well as recognize and identify potential problems quickly and accurately.
- Automated quality control using software applications and, possibly, commercial packages designed to flag potential problems.
- Efficient quality control by human beings in areas not handled well by machines.
- Automated post-processing using software applications that enter metadata into databases and embed metadata into digital files, create derivatives, copy files, regenerate checksums, etc.

All of these features, with the exception of automated quality control software, are already in place in the audio preservation workflow used by the Sound Directions project. They must be adapted, refined, expanded, and further developed to support transfer of video recordings as well as the particular context and scale of the Indiana Media Preservation and Access Center.

These procedures are incorporated into our data projections, which show that we will meet our transfer targets within the defined timeframe using this mix of workflows. The Task Force believes that this approach also largely resolves quality and preservation questions and will produce digitally preserved content that will remain manageable and useable over a very long period of time.

Task Force Recommendations

6. Use a 1:1 digitization workflow in combination with 2:1 and 4:1 parallel transfer workflows to both meet campus preservation goals and complete preservation transfer work within fifteen years.
7. Develop software applications to automate as many tasks as possible to support high-efficiency workflows.

Media Preservation Prioritization Plan

Key Points

Not everything will be preserved. Degradation, obsolescence, and cost make it impossible to preserve all items plus low value holdings may be inappropriate candidates for long-term preservation.

A prioritization process is in place and is undergoing field testing. It features the use of software tools to aid a structured assessment of preservation condition/obsolescence and research/instructional value.

The prioritization process emphasizes a full collaboration with unit curatorial and/or custodial staff.

An initial five-year prioritization plan will be developed during the next year of Task Force work.

Some holdings may be judged inappropriate candidates for long-term preservation. In addition, the forces of degradation, obsolescence, and cost may make it impossible to preserve all appropriate candidates given the size of campus holdings. For these reasons it is necessary to identify priorities for preservation treatment.

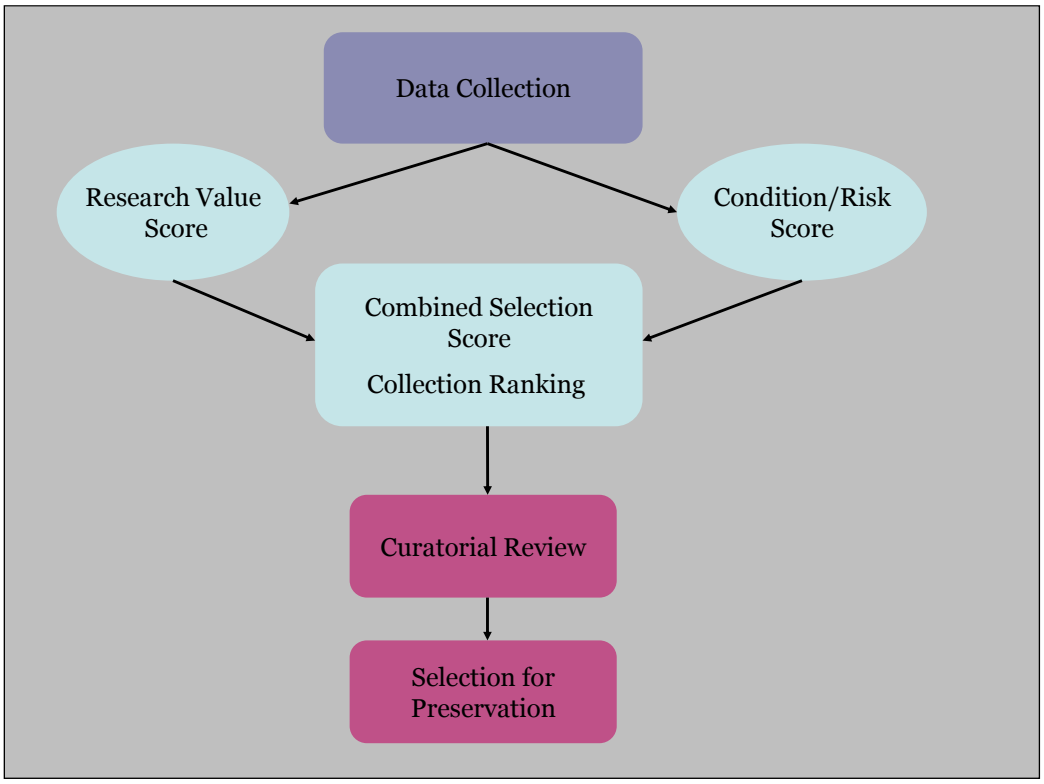
One of the major goals of the Media Preservation Initiative is to create a prioritization plan for Indiana University Bloomington media holdings. The plan will feature a prioritized list of collections (and other groupings of media objects) selected for preservation over the next five years. The list will be developed in collaboration with unit curatorial staff by analyzing media collections for both research value and preservation condition as outlined below. The plan will also detail which formats and collections must be outsourced for preservation transfer and which can be preserved in-house. Finally, it will lay out strategies for digitally preserving all IU Bloomington collections with significant research value within fifteen years.

Media Preservation Initiative work has focused so far on developing the build plan for the IMPAC. With this complete, the Task Force will now pursue creation of a prioritization plan. A proposed process for this work was discussed and approved by the Advisory Board at its first meeting. While the challenges presented by this work are widely recognized, both the Task Force and the Advisory Board members believe that the process outlined below, with its focus on a collaborative structured assessment of holdings, is the strongest way to proceed.

Selection for Preservation

Selection (or prioritization) for preservation, which is closely related to the archival appraisal process, typically includes an assessment of both research value and preservation condition. The first involves careful evaluation of the significance of a collection, assessing its potential value to researchers both now and in the future. The second requires an analysis of the risk borne by a collection including the level of degradation that is either present or expected based on its specific format, storage history, or current condition. Collection curators may also need to take into account political, economic, technical, donor-related, and other issues in making selection decisions. Figure 6, below, presents a high-level view of the selection process as we envision it at IU Bloomington.

Figure 6: Selection for Preservation Steps



The Task Force recommends conducting a structured assessment of research value and preservation condition using software tools that place collections in priority order on a points-based scale. Although the selection process is inherently subjective, using software for these steps will impart a measure of objectivity and transparency to the process. The Task Force also acknowledges the importance of the curatorial review step during which curators use their knowledge of collections to weigh additional factors that are not covered in the scores produced by software applications. During this step, collection scores may be refined based on curatorial knowledge.

RESEARCH VALUE

There are no existing software applications that aid assessment of the research value of media collections. Indiana University Bloomington, however, is developing such an application through the NEH-funded Sound Directions project. Named RIVERS (Research and Instructional Value Evaluation and Ranking System), the software will facilitate a structured assessment of research value through the scoring of collections in the following areas: significance, rareness, extensiveness, detail, research interest and use, functional value, local value, accessibility for research use, generation, and other factors. Development of this application is guided by an advisory group of key campus stakeholders that includes representatives from University Archives, the Lilly Library, the Music Library, the Archives of Traditional Music, the Archives of African American Music and Culture, and the Digital Library Program. Conceptual work is nearly finished, and development of the software will begin later in 2011.

The Media Preservation Task Force is keenly interested in the development of RIVERS and plans to use it to evaluate campus media collections. The application, however, may not be available for as much as a year depending on the scheduling and progress of programming work. In the interim, we have developed a checklist of categories and questions from RIVERS development for use with IU Bloomington units. With this checklist, we will undertake with curatorial staff a more holistic analysis resulting in the placement of a collection on the scale presented below. This procedure will be used in developing the initial five-year priority plan.

The process of assessing research and instructional value will be carried out collaboratively with curatorial and/or other unit staff. Task Force members (or IMPAC staff) will provide expertise in the process and the software tools while curators supply expert knowledge of their collections. After scoring with RIVERS or engaging in a discussion based on the checklist before RIVERS is available, media collections will be placed on the research value rating scale detailed below.

Table 3: Collection Research Value Rating Scale

Points	Research Value Statement
4.4-5	**Collection has exceptional research value. It contains detailed and/or unique or very rare content presenting a full and deep look at highly significant topics and/or people.**
3.6-4.3	**Collection has high research value. It contains detailed and uncommon content about significant topics and/or people.**
2.6-3.5	**Collection has moderate research value. It may contain spotty detail about significant subjects or rich detail about less significant subjects.**
1.6-2.5	**Collection has minor research value. It contains routine or scattered material providing only superficial information. It may consist of copies of material elsewhere.**
0-1.5	**Collection has no research value or has minimal research value.**

PRESERVATION CONDITION AND RISK

Scoring collections for preservation condition and risk incorporates evaluations of the following:

- obsolescence of the format
- technical characteristics of the format that indicate greater risk
- presence of preservation-related problems
- current condition

The Task Force continues to evaluate several software applications that rank media recordings in this area. The application we choose must allow production of evaluations at the collection level, rather than ranking each individual recording, which is unmanageable for institutions with very large holdings.

Scoring collections for preservation condition and risk requires technical expertise in media preservation including in-depth knowledge of media formats and the mechanisms by which they degrade. This work will be carried out by Task Force members or IMPAC staff supported by graduate students. We will welcome assistance from units with media preservation experience.

PRIORITIZATION PROCESS AT IU BLOOMINGTON

The archival field generally considers that the related activities of appraisal and selection for preservation are best guided by a set of institutional policies that define the goals of the archive. This may include an acquisitions or collection development policy or a mission statement that provides a touchstone for prioritizing and choosing. The frame of reference for evaluating research and instructional value then is the single unit or institution—if a collection is judged of high value, it is valuable to the holding unit as defined by that unit's priorities articulated in policy documents.

The task of the Media Preservation Initiative is to prioritize media collections for the Bloomington campus. This is a challenging proposition as the campus itself does not maintain an archival collection development policy. The campus also includes more than eighty units with media holdings, each with different notions of what is or is not valuable to their mission. It is difficult to imagine ranking collections with consistency and integrity across units, not to mention reaching agreement across campus on the relative value of the various and diverse media collections. For these reasons, the Media Preservation Task Force recommends trying to achieve consistent rankings within each unit only. The Task Force will then highlight each unit's top priorities as campus preservation priorities. This enables unit curatorial staff to maintain significant control over the prioritization process for their content. The IMPAC, when built, will have the capacity and operating efficiency to guarantee that top priorities will be preserved within its defined fifteen-year preservation period.

Not every collection can be a top priority, and the Task Force has established targets and recommendations for the ranking process, which will guide the work of each unit. The evaluation process will be carried out collaboratively between members of the Task Force (or IMPAC staff), who will provide expert guidance as well as assistance with the work, and unit curatorial staff. The steps in this process are outlined below. A successful trial of this process was completed with University Archives and Records Management with additional tests at other units upcoming.

1. Meeting with unit curatorial staff and Task Force
    - Discuss steps in the prioritization process and development of the overall prioritization plan.
    - Select collections or groupings of media recordings considered to be of highest value and/or most at risk.
2. Analysis of risk, preservation condition, and obsolescence
    - Task Force uses a software application to score collections.
3. Analysis of research and instructional value
    - Task Force and curatorial staff use RIVERS (or a checklist list derived from it) to score collections.
4. Analysis of other variables
    - Task Force and curatorial staff add other variables to consider.
    - Other considerations that may be taken into account include timeliness (upcoming events or anniversaries) and publicity opportunities.

5. Final scoring
    - Task Force and unit curatorial staff discuss and certify final collection scores.

Outsourcing

Some formats are so far along the path of obsolescence that they require extraordinarily hard-to-find and expensive playback machines and very specific operational expertise. Others are experiencing levels of degradation that necessitate the playback experience of a specialist in the particular format and its problems. IU Bloomington holdings for still other unusual or highly obsolete formats are so small that it may not make sense to develop in-house expertise. In these situations, it is not cost effective to devote the resources necessary to perform solid in-house preservation work. Collections carried on these formats, if prioritized for preservation, must be outsourced to a vendor with the experience and expertise to treat them. Formats at IU Bloomington that are marked for outsourcing include:

- 2" Quad videotape
- ½" open-reel videotape
- Laserdisc
- Metal parts (audio discs)
- Audograph disc
- Eight-track tape
- Fidelipac audio tape cartridge
- Minicassette
- Soundscriber audio tape
- Sony PCM-F1 digital audio
- DA 78/88 tapes

In addition, it may be necessary to outsource to expert vendors a small number of highly problematic items in any format.

Task Force Recommendations

8. Prioritize campus media holdings for preservation by conducting a structured assessment of research value and preservation condition with each media-holding unit.
9. Fully involve unit curatorial and/or custodial staff in the prioritization process.
10. Develop a five-year prioritization plan as soon as possible followed by priorities for the remaining holdings over the ensuing ten years.
11. Pursue the rapid development of the research value assessment tool RIVERS for use in the prioritization project.

Video Preservation Pilot Project

At their fall 2010 meeting, Media Preservation Initiative Advisory Board members remarked that while considerable expertise in audio and film preservation existed on the IU Bloomington campus, the equivalent for video did not. On campus, there is video preservation experience within the Mellon-funded EVIA project, at the Archives of Traditional Music, and at the Jacobs School of Music, but not to the same breadth or depth as for the other media types. There is also a wealth of video *production* experience at Radio and Television Services. While production shares skills with preservation—how to attain optimal playback, for example—it entails different goals and perspectives and operates under different principles.

From this discussion emerged a plan to undertake a small video preservation pilot project as a collaboration between the Task Force and Radio and Television Services. Additional partners included the Archives of Traditional Music and IU Bloomington Libraries. The overall goal of the pilot project was to gain working experience with the various technical issues involved in preserving analog video recordings such as file formats and wrappers, file sizes and bandwidth, storage needs, workflows, and others. The Task Force was also offered the opportunity to evaluate a demonstration version of an integrated and partly automated video transfer system called SAMMA. Because this system is a possible option for the IMPAC, and because the need to gain additional experience with video was clear, the timing seemed ideal to undertake this project.

Preservation transfer of analog video recordings and evaluation of the SAMMA system took place in February and March 2011. Mike Casey from the Task Force and John Wright from Radio and Television Services each invested more than 40 hours in learning the SAMMA system and transferring video tapes. Rachael Stoeltje (Task Force) and Howard Lacer (Radio and Television Services) also participated. Content for transfer was provided by Radio and Television Services, IU Bloomington Libraries, and the Archives of Traditional Music, and included the following:

- An opera by John Eaton entitled *Myshkin* that was performed by IU artists and produced by WTIU for national broadcast in 1972. This was a made-for-TV production for the Corporation for Public Broadcasting that won a Peabody Award. The opera was performed in the WTIU studio and originally recorded on the 2" Quad format. Because the original tape no longer exists, we transferred a copy in the obsolete 1" format.
- The funeral of Herman B Wells, March 22, 2000, broadcast by WTIU.
- A WTIU recording of the 25th anniversary concert of the esteemed Beaux Arts Trio featuring pianist Menahem Pressler from 1981.
- A WTIU documentary of revolutionary IU swimming coach Doc Counsilman entitled *Doc Counsilman: Making Waves* from 2008.
- A recording from the Archives of Traditional Music of a 1986 appearance by Hoagy Carmichael on the *Mister Rogers' Neighborhood* show.
- An IU Libraries recording of the documentary *Masters of Disaster*, a 1985 production that documents an inner-city school in Indianapolis that won the national chess tournament.
- An IU Libraries recording of the 1980 IHSAA boys' basketball championship game between Broad Ripple and New Albany.
- A documentary held by the Archives of Traditional Music on 'Are' are music from the Solomon Islands, made by renowned ethnomusicologist Hugo Zemp.

The ongoing work on this project is providing an opportunity for the collaborators to share knowledge and perspectives in addition to meeting project objectives. For example, Task Force members learned much about playback of obsolete analog video formats including issues involved in working with finicky playback machines, the location of audio signals on tape for various formats, and how typical problems with tapes or machines display visually. Radio and Television staff, in turn, gained a deeper understanding of decisions, choices, and procedures that are appropriate for preservation work.

Educating and Training Students in a Media Preservation Center

Although media permeates our society, and media preservation issues are increasingly viewed as critically important, there are few places in the United States where students can pursue training and experience in this field. The table below presents specific examples of potential training opportunities for students in the proposed Indiana Media Preservation and Access Center. These are meant to be suggestive, not exhaustive. The Task Force also recognizes opportunities for engagement of center staff in existing courses in departments such as Recording Arts, Telecommunications, and Communication and Culture, as well as the School of Library and Information Science, in addition to any discipline that relies upon time-based media for its work. There may also be opportunities to team-teach new courses in any of these areas or develop less technical seminars focused on media preservation issues for units such as the Collins Living-Learning Center or the Hutton Honors College.

Table 4: Student Training Opportunities in the Indiana Media Preservation and Access Center

Location in Workflow	Type of Student	Supervision	Overview of Tasks
SMART (Strategic Media Access Resource Team)	SLIS graduate student	Media Preservation Specialist, IUB unit staff	Identify, barcode, diagnose problems, collect data, assign numbers, pack, help transport
Center Intake	SLIS graduate student	Collection Processing Assistant	Register incoming items, unpack, data entry
Audio Digitization	Department of Recording Arts or Telecommunications intern	Audio Preservation Transfer Specialist	Learn digitization workflow including manipulation of playback machines, A/D conversion, technical metadata collection, QC, file handling
Audio Digitization—Parallel Disc Transfer	Recording Arts or Telecommunications hourly	Audio Preservation Transfer Specialist	Perform digitization workflow for parallel transfer of commercial discs
Video Digitization	Telecommunications, Communication and Culture, or Recording Arts intern	Video Preservation Transfer Specialist	Learn digitization workflow including manipulation of playback machines, A/D conversion, technical metadata collection, QC, file handling
Video Digitization—Parallel Tape Transfer	Telecommunications, Communication and Culture, or Recording Arts hourly	Video Preservation Transfer Specialist	Perform digitization workflow for parallel transfer of commercial videotapes
Film Digitization	Telecommunications or Communication and Culture (Film and Media Studies Program) hourly or intern	Film Transfer Specialist	Perform film digitization workflow
Prep for Digitization	Recording Arts, Telecommunications, SLIS, Communication and Culture, Folklore and Ethnomusicology hourly or intern	Audio/Video Technician or Film Technician	Prep workflow including inspecting, diagnosing problems, cleaning, photographing, simple repairs
Processing	SLIS graduate student hourly or intern	Collection Processing Assistant	Quality control, technical metadata collection, file handling
Software applications and scripts	Informatics and Computing hourly or intern	Software Developer	Development of workflow and infrastructure software applications
Descriptive practices (including cataloging)	SLIS hourly or intern, Language student	Media Cataloger, IUB unit staff	Development of catalog records and finding aids, assistance with languages

5 Strategies for Film

Key Points

IU Libraries' educational film collection may be considered a critical research resource within the context of the recent worldwide scholarly interest in non-fiction film.

The cornerstone of IU Bloomington's preservation strategy for film is storage in the Auxiliary Library Facility that maintains 50 degrees F and 30 percent relative humidity, buying time for the maturation of preservation methodologies.

Digitization is not yet considered a viable long-term *preservation* strategy for film but it is key for *access* to film content and must begin immediately.

Digitization technologies for film are evolving rapidly, and a gradual start to access digitization is recommended.

When technologies mature, a rapid and massive digitization effort must be initiated to preserve and provide access to film content. This will require allocation of substantial resources.

Making large portions of campus holdings accessible via digital files represents a significant strategic opportunity, as relatively few others are doing so.

The recent opening of the IU Cinema provides a welcome opportunity to partner on projection of selected campus holdings.

The Collections

Indiana University Bloomington holds one of the largest and most diverse collections of film at any university in the United States. These holdings range from personal collections of filmmakers and collectors to a large number of educational films that were rented to schools, libraries, and colleges across the country from before World War II until the end of the twentieth century. Collections held by IU Libraries include

- The Lilly Library's holdings of the personal collections of filmmakers Orson Welles, John Ford, and Peter Bogdanovich;
- The Lilly Library's Bradley Film Collection, one of the most comprehensive film; collections ever assembled by an individual collector, consisting of 3,964 16mm films;
- The Indiana University Libraries educational collection that dates from before World War II and contains more than 46,000 titles. The Bloomington campus was for decades one of the largest distributors of educational and classroom films in the United States;
- The University Archives collection of thousands of athletic game films and other motion picture material related to the history of Indiana University.

Other key collections on campus include

- The Kinsey Institute film collection, consisting of approximately 9,000 film titles ranging in date from 1915 through the 1970s and a variety of formats including super 8, 8mm, 16mm and 35mm; and
- The Black Film Center Archive Collection of more than 900 important films spanning the century, made by independent filmmakers.

Approximately 80 percent of campus film holdings reside with IU Bloomington Libraries. Highlights from the Libraries' holdings include the Peter Bogdanovich film collection, acquired by the Lilly Library in 1994. This collection, from the director of *The Last Picture Show*, *What's Up Doc?,* and *Paper Moon,* among others, contains original film elements, gag reels, "behind the scenes" promotionals, trailers, and release prints. Many of these items are valuable not only for researchers, but also as both source and bonus material for restorations and future re-releases.

The Lilly Library acquired the David S. Bradley Film Collection in 1997. The 3,964 16mm films comprise one of the most comprehensive film collections ever assembled by an individual collector. The collection spans the history of cinema in the United States and Europe, including both classic and obscure films from France, Germany, Italy, Russia, England, and Scandinavia, as well as the films of the world's most acclaimed film-makers. The silent era is represented particularly well by the collection.

The largest component of the IU Libraries holdings is the educational film collection, one of the last and most extensive 16mm historic educational film collections remaining in the country today. The collection, which dates from before World War II, contains more than 34,000 film titles and more than 8,000 video titles. In November 2010, the Libraries Film Archive added 12,000 educational films from Lane Education Service District, bringing the total number of titles to more than 46,000. Indiana University was one of the major distributors of educational classroom films from the 1930s through the 1990s. The educational collection contains social guidance films, World War II propaganda films made by the U.S. Department of War, career training films, and more than 5,300 National Educational Television programs including more than 6,000 NET original elements.

With the recent rethinking of film and media studies methods and priorities, previously neglected genres such as instructional and other non-theatrical films are drawing significant interest from scholars. Educational films in particular have become a major focus for researchers from a number of disciplines who are exploring the historical and sociopolitical implications of the films that brought the world into classrooms for more than 50 years. Within these contexts, the IU Libraries' educational collection may be viewed as a critical resource. The films and their accompanying guides are rich in material relevant to the study of gender, globalization, environmentalism, regionalism, and race, offering important information about how these topics were visualized and taught in different contexts over different historical periods. They represent a broad swath of American—and international—culture during a half-century that saw major changes across all aspects of American life, from agriculture and the industrial workplace to the "problem" of adolescence and understanding of civic values, from suburbia to the inner city. This collection of films and study guides together also illustrates the history of educational and documentary film production, as practiced by industry, government, non-profit agencies, and firms specializing in the classroom market. If this collection can be preserved and made accessible, it will serve numerous research agendas in the years to come.

Preservation

The development and rapidly growing use of digital technologies in the commercial film industry, in film laboratories, and for patron access is changing the way archival film collections are managed and conceptualized. Despite the introduction of digital tools and methodologies, digitization is not considered a viable long-term preservation strategy for film at this time.[24] This stands in marked contrast to audio and video holdings, for which digital preservation is widely considered the best, if not only, way forward. The issue is partly one of resolution—many practitioners feel that current digital technologies do not capture image or audio from film without unacceptable loss. The issue is also one of sensory perception. An analog system based on creating images through the opening and closing of a shutter as well as a photochemical process presents a different viewing experience than a digital system. Some would argue that the two provide different representations of reality.[25] Other issues include lack of standardization, lack of digital infrastructure, and the enormous data storage needs of digital files created from film transfers with attendant costs.[26]

If stored properly and not already significantly degraded, film is stable compared to audio and video recordings, which have much shorter life spans. Therefore, film can be preserved physically, bypassing for now the need to enter the digital domain with its accompanying challenges of ever-changing file formats and data codecs, as well as the need for long-term institutional management of file conversion, data integrity checking, and migration. So, digitizing all film holdings with significant research value does not at this point in time guarantee their long-term preservation. Film-to-film transfer, which is expensive and requires considerable expertise as well as specialized equipment, is currently the only widely accepted solution for enduring preservation of film-born content. This work is done by specialist laboratories whose numbers are dwindling as commercial film production increasingly moves into the digital domain.

Even so, many experts foresee a time when film will either no longer be manufactured or will be made in very limited quantities. In this scenario, which some predict may occur within ten years, blank film stock is either non-existent or prohibitively expensive, making film-to-film transfer nearly impossible.[27] Add the rapid development of digital technologies, and one can easily portend a digital future for film preservation—at some point there will be no other choice.[28] It is not possible to know when the field will reach this point, but it is critical to be ready to move when it does.

Film preservation strategy over the past twenty years has increasingly focused on storage conditions as new research showed that the life of film could be significantly extended in lower temperatures with controlled humidity. The cornerstone of IU Bloomington's

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[24] See Giovanna Fossati, *From Grain to Pixel: The Archival Life of Film in Transition* (Amsterdam, the Netherlands: Amsterdam University Press, 2009), 63-65. For example, recent studies such as the European projects FIRST and PrestoSpace have concluded that digital technology is currently suitable for the long-term preservation of video, but not film.

[25] See the discussion in Fossati, *From Grain to Pixel*, 110-13. A strong statement of this position appears on page 112: "Indeed, from the realists' perspective the ontological question becomes fundamental at a time when a digital mode of reproduction is replacing the photochemical mode. Once a photographic image is transcoded into digits, it may be argued that it loses its direct correspondence with the real." Others disagree or see the issue as more nuanced, as explored on the following page.

[26] *Film Preservation Guide*, 44; Fossati, *From Grain to Pixel*, 65.

[27] Fossati, *From Grain to Pixel*, 65.

[28] In Fossati, *From Grain to Pixel*, 14: "However, although analog and digital technologies at this point complement each other in a hybrid form, digital technology is still expected to take over film and other media altogether."

preservation strategy for film holdings is storage in the Auxiliary Library Facility (ALF) which maintains stable conditions at 50°F and 30 percent relative humidity. All film within the library system, the Kinsey Institute, and the Black Film Center Archive—totaling more than 86,000 film cans—has been moved to ALF in the first half of 2011. Some important smaller collections, such as those at the Archives of Traditional Music and the Athletics Department, are not in ALF. It is imperative to move all remaining campus film designated for long-term preservation to this facility as soon as possible. Storage in ALF conditions buys significant time for the development and maturation of technically sound and affordable preservation methodologies. For example, the time before the onset of vinegar syndrome degradation is estimated at only thirty to forty years for film that is stored in room temperature conditions and is not yet degrading. Storage in ALF increases this time to approximately 300 years. The disadvantage of this type of storage is that the films are not readily accessible for research, hence the proposal discussed below to digitize film for access purposes.

Even ALF will not help films with advanced vinegar syndrome, which must be frozen and then duplicated as soon as possible. The ALF facility includes a new freezer in which severely degraded items are stored. For these items, part of the preservation strategy is to pursue film-to-film transfer for the most severely degraded items with the highest research value. Because this is prohibitively expensive for a large collection in its entirety, this strategy will likely be limited to a relatively small number of titles. It cannot wait, however, because of ongoing degradation and the dwindling number of laboratories that can do this work. For these reasons, the Libraries are aggressively pursuing preservation funding from grant programs and private foundations. In fact, the National Film Preservation Foundation just awarded the Libraries a grant for film-to-film preservation work on a selection of the Lilly Library's John Ford home movies. We will also cultivate relationships with private donors who are specifically interested in film and may be willing to undertake preservation of specific titles.

With relatively long-term preservation secured through storage, the campus can use film-to-film transfer in a targeted way to address specific critical issues as described above. In addition, we do not need to depend on lower-quality access digitization to preserve content over time. Therefore, with the exception of severely degraded items, it would seem that we have the luxury of pursuing an unhurried duplication strategy. This is too limiting, however, as it serves preservation but does not address access, without which preservation is meaningless. Locking content away in storage for many years is not acceptable, either to collection custodians or researchers. Also, there are technical issues that complicate relying solely on storage conditions for long-term preservation needs. For example, color fading in films is incompletely understood, and some reports suggest this problem may prove worse than expected. It may not be completely arrested by better storage conditions.[29] Plus, the temperature maintained by the campus Auxiliary Library Facility is not considered ideal for slowing color fading.[30] Digitization sooner rather than later may be necessary to support the preservation of color content. There are also strong strategic reasons to develop an aggressive access digitization program. These are explored below.

[29] See European Film Heritage on the Threshold of the Digital Era: The FIRST Project's Final Report: Conclusions—Guidelines—Recommendations (Brussels, Belgium: Royal Film Archive, 2004), accompanying CD-ROM, FullReport_Part1.pdf, 33, which states: "Reports from Hollywood suggest that no camera negative from pre-1980 is unfaded, however stored, and no print from pre-1985."

[30] The IPI storage calculator, https://www.imagepermanenceinstitute.org/imaging/storage-guides, suggests cold storage of around 40 degrees F for color film. ALF maintains 50 degrees.

Access

IU Bloomington film holdings have only recently been made available for discovery through the IU Libraries' online public access catalog, yet when the records were not available, the Libraries' Film Archivist received at least one request per week for access to this content. The Task Force strongly suspects that the combination of online discovery with the future availability of digital files will result in a blizzard of researcher requests to view these films. The Task Force also believes that with the planned massive digitization of audio and video holdings comes a strategic opening for access digitization of film, which would allow us to make large holdings of time-based media content accessible for research use across the various media types. The IU Libraries have already digitized more than 100 deteriorated titles from the Bradley collection and are currently in the process of digitizing another 196 educational collection titles for access. Few institutions are currently providing ready access to large film collections, and even fewer to the types of collections (educational films, for example) held at IU Bloomington.[31] Making large portions of campus film holdings available would lead to clear benefits to the institution, supporting numerous research agendas and attracting students. Combined with the opening of the new IU Cinema and strong existing film studies programs, accessible archival holdings would foreground Indiana University Bloomington as a prominent place for the serious study and use of film.

With the planned massive digitization of audio and video holdings comes a strategic opening for access digitization of film, which would allow us to make large holdings of time-based media content accessible for research use across the various media types.

The Task Force recommends developing a vigorous access digitization program that focuses on educational and documentary holdings. These represent the largest part of the film collections (approximately 46,000 items), and for at least some titles rights are not an issue.[32] Access digitization may also be considered for portions of the collection with preservation issues for which film-to-film transfer is not possible but where producing a copy would support the longevity of the content. While copies from access digitization cannot compete with the image quality of film, the technical characteristics of our most common format (16 mm), and the nature of the subject matter and typical use, suggest that for this part of campus holdings access digitization will prove fully acceptable for research use. It is important to note, however, that when digitization for preservation becomes technically and economically feasible, then the digitization effort produces both high-quality preservation masters and lower-quality access derivatives.

Because digitization technologies are rapidly evolving in this area and tremendous changes are expected over the next three to five years, we suggest a phased development of this program rather than an immediate rapid and massive effort to digitize everything. Committing to the wrong technology today would ultimately limit, if not hinder, our efforts moving into the future. Phase one will feature the purchase of digitization equipment based

[31] The one notable exception is Rick Prelinger's collection of educational films, 2,000 of which may be streamed from the Internet Archive.
[32] Either IU Bloomington produced these films and holds the rights, they are already in the public domain, or they were made by the federal government and are available by law.

on scanning technologies and developed with archival use in mind. There are a number of developing machines in this category. Because none of them are fully developed yet we plan to begin with just one workstation.

Note that we are not choosing traditional telecine-based approaches, which were originally developed for conversion from film to video. These setups are expensive, outdated, and generate a file that does not maintain the integrity of the original. The modern day industry-equivalent to the telecine—which does maintain the integrity of the original—is also very expensive and generates an output that is oriented toward use as a digital intermediate file in a production process. This is not well-suited for archival purposes.

We plan to use the scan-based workstation to create 2K scans of primarily 16mm films. The term 2K refers to resolution, and it is widely thought that scanning at this level, if done well, can satisfactorily represent the detail in a 16mm film. A 2K process is data-intensive and, therefore, significantly more expensive than producing a more commonly used HD file. The Task Force believes, as does the campus advisory board, that scanning at this level will enable any type of future reuse of campus films (in documentaries or projection at the IU Cinema, for example) whereas a lower resolution would be limiting. Given that film-to-film transfer will likely never be possible for most of the collection and that large-scale rescanning will not be feasible, the Task Force believes that 2K scans will best serve the long-term preservation of the content. Note, however, that there are technical issues that may make HD a more feasible choice if we were to purchase a workstation today. We will monitor the technology until we reach our purchase point to see if these are resolved. Phase one of our program will also include the hiring of one transfer specialist supported by one film technician. The initial strategy is to begin filling researcher requests while adding to the store of available content in a focused yet unhurried way.

It is critical, however, to closely monitor technological changes in this area and be prepared to move quickly as technologies mature. A rapid and massive digitization effort must be initiated at the appropriate time if the collection is to be satisfactorily preserved and made accessible. Phase two of our program will emphasize a technology watch for the next three to five years. If a superior access digitization technology emerges or if preservation digitization becomes economically viable (in which case preservation and access efforts merge), we recommend allocating substantial additional resources to the film program. This would include at minimum hiring an additional film transfer specialist and a film technician as well as purchasing equipment. If nothing emerges during this time period, a close technology watch will continue until it is strategically appropriate to move forward.

In today's media-saturated culture, users are less likely to be audiences in a theater than individuals connected to content virtually. These users want direct, unchaperoned access to content.

Access digitization enables IU Bloomington to present film-born content in nontraditional contexts including delivery of digital files over the web. Some film scholars and archivists believe that film is best experienced as film projected in a traditional theater setting. However, the Task Force feels that delivery via nontraditional contexts is not only appropriate for our institution but also feasible, and even a priority given IU's state-of-the-art IT services,

networks, and commitment to digitization of a number of formats. We also believe that some of the objections to digitization centered on issues of resolution and sensory perception pertain more to fiction films and less to the educational and documentary materials that are the core of the IU Bloomington collection. The Task Force further notes that digitization can also serve the campus commitment to media and film studies as it enables access to substantially more film-born content to support research and teaching. In addition, in today's media-saturated culture, users are less likely to be audiences in a theater than individuals connected to content virtually. These users want direct, unchaperoned access to content—a need that is best met through web delivery.[33] Note that in some cases specific research agendas may require direct access to film, which can be accommodated using flatbed viewers for stable items under the supervision of university personnel.

With the recent renovation of the IU Cinema into a state-of-the-art projection facility, the Task Force also recommends prioritizing access to campus archival film through the more traditional projection-in-a-theater experience. We are already cultivating close working relationships with cinema staff, collaborating with them to select appropriate titles and providing prints for projection. While this may never account for the majority of access to archival film content, it will provide the increasingly rare opportunity to experience some of these items in the presentational context for which they were made.

Ongoing Film Collection Preservation and Access Efforts by the IU Bloomington Libraries

The Indiana University Libraries are dedicated to the preservation of and access to the motion picture film collections and related material held across the university library system.

Within the past few years, the Libraries have committed to preserving all IU Bloomington film collections by allocating space in the climate controlled storage facility, the Auxiliary Library Facility. All of the Libraries' film collections were moved to this facility between 2006 and 2010.

The Libraries' diverse and varied motion picture film collections make up 80 percent of the motion picture films on the Bloomington campus, and many have already been cataloged and made accessible. These collections are discoverable in finding aids and in the online IUCAT catalog. Other collections, including the 46,000 items in the historically important educational film collection, are currently in the process of being cataloged and will be made accessible to scholars and researchers in the very near future.

The IU Libraries actively support the film collections by

- providing a long term, climate-controlled, secure storage facility;
- maintaining active partnerships with scholars locally, nationally, and internationally, as well as with the IU Cinema and other universities, archives, and venues;
- allocating resources based on established priorities and seeking strategic partnerships and outside funding;

[33] For more discussion of these issues, see Fossati, *From Grain to Pixel*, 96-97.

- providing facilities, technology, data management, and information retrieval that enable faculty and student researchers to access these resources to create new knowledge.

Summary of Strategic Approach for Film

Table 5, below, summarizes IU Bloomington's strategies for its film holdings.

Table 5: IU Bloomington Strategies for Film

Action	Explanation
Store all campus film in ALF	Lower temperature and relative humidity significantly extends film life; buys time for other approaches to mature
Film-to-film preservation transfer	For highest value and most severely degraded items
Access digitization, phase one	Beginning immediately, focused but paced work to fill researcher requests, support preservation of content, and add to available content for research use
Technology watch—formal assessment at three and five years	Determine the best moment to move to more advanced technologies
Full scale preservation and/or access digitization	Rapid and massive conversion to digital files, dependent on technology development

Task Force Recommendations

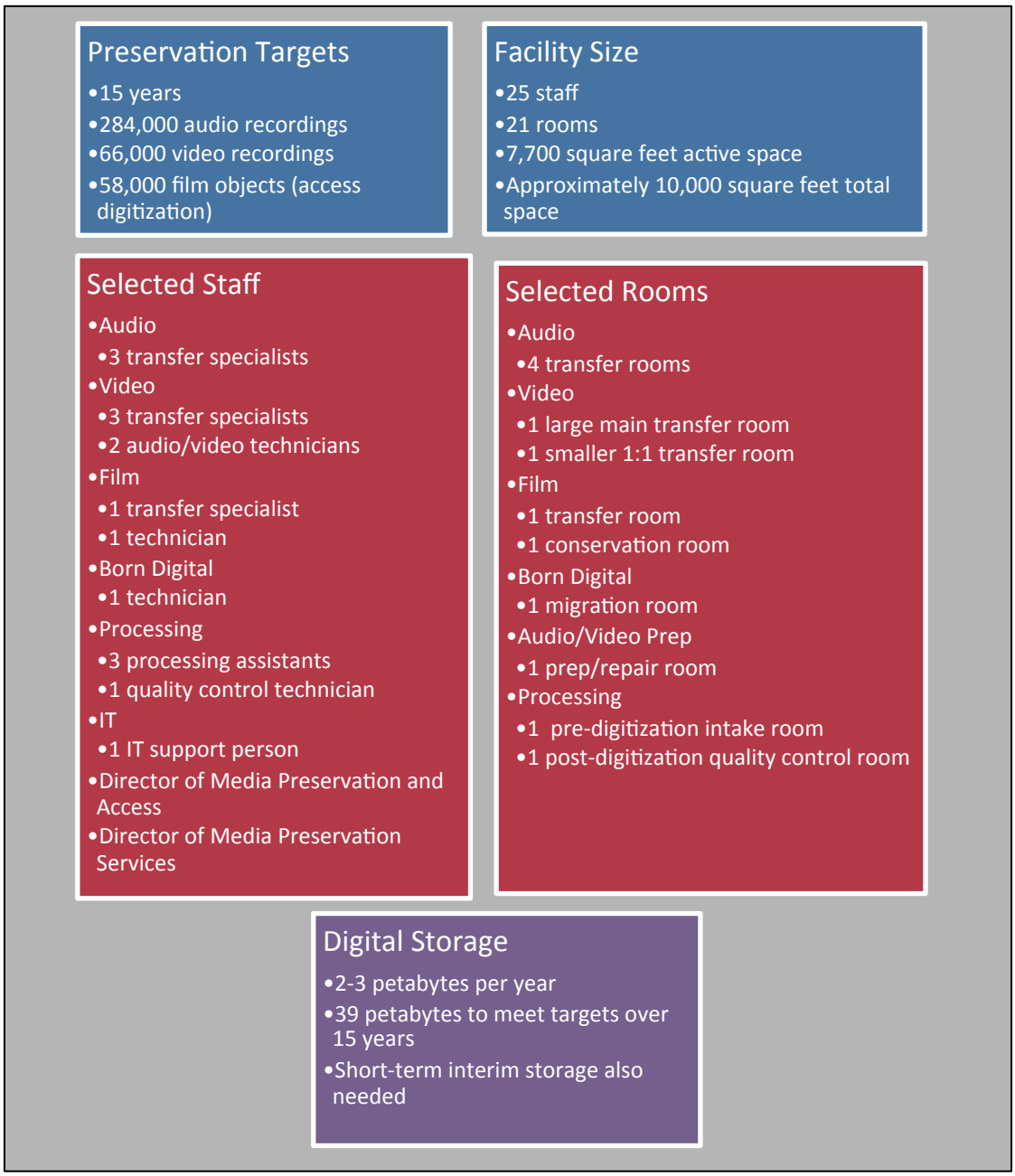
12. Store all campus film holdings in the Auxiliary Library Facility to ensure their survival.
13. Seek funding for film-to-film preservation of the most severely degraded items with the highest research value or of greatest national importance.
14. Undertake a close watch of digitization technologies with a formal analysis within five years to identify strategic opportunities to pursue massive digitization for preservation and/or access purposes as appropriate.
15. Allocate resources to complete the rapid and massive digitization of film holdings once technologies mature.
16. Begin a phased access digitization program immediately to provide researcher access and to aid the long-term preservation of content.
17. Develop a strong partnership with the IU Cinema for the screening of archival film.

6 Facility Planning

Overview

This section presents the Indiana Media Preservation and Access Center (IMPAC) build plan developed by the Task Force. It outlines the process by which we developed this plan and discusses the data behind it. Below is a diagram that summarizes key features of the plan.

Figure 7: Key Features of the IMPAC Build Plan



Preservation Targets

Our primary target relates to time. As discussed above, the Task Force recommends preserving campus audio and video holdings within a fifteen-year time frame due to rapidly worsening degradation and obsolescence issues as well as to take advantage of strategic opportunities for research use of all materials, including film. The group recommends beginning this work no later than 2013. The high-level research value analysis of campus collections discussed below yielded the numerical targets for each media type shown in Table 6 below. This build plan is constructed to meet these targets within the desired time frame, which stretches to 2027.

Table 6: Media Preservation Targets, 2013-2027

Target	Hours	Objects	% of Total Holdings
15 Years— all media types	317,000	408,000	71%
Audio	207,000	284,000	82%
Video	83,000	66,000	53%*
Film (access digitization)	27,000	58,000	69%

**IU Bloomington video holdings include a large number of non-archival, commercial VHS tapes and DVDs that circulate primarily to students. These are not included here.*

Facility Planning Process

Role of Data

The analysis of in-house and outsourcing issues discussed above convinced the Task Force that building a media preservation facility was both desirable and necessary within the IU Bloomington context to reach preservation and access goals and to preserve campus holdings cost effectively. The build plan created by the Task Force was developed through a strongly data-driven process. Our recommendations—including number and type of staff, number and type of media studios, square footage needed, and digital storage required—were derived directly from data on campus time-based media collections combined with analysis by Task Force members with assistance from consultant AudioVisual Preservation Solutions (AVPS). We worked from the inside out, letting the data lead us to conclusions regarding size and scope. This build plan is a model—real-life operations are not so linear or tidy—but its projections are based on data we developed and analyzed. The results of this work provide defensible estimates of what is necessary to reach our defined targets within the fifteen- to twenty-year window of opportunity discussed above. Note that the Task Force has chosen fifteen years as its target.

Data Development

The build plan process began with data from the Media Preservation Survey project that was completed in 2009. This work provided us with a mix of actual counts and estimates of audio, video, and film objects held by campus units. This is useful but not enough to accurately predict the resources needed to preserve media holdings. A more helpful data point is

playback (or running) time, which can be combined with existing metrics that address the time required to preserve one hour of playback time in any given format. A subgroup of the Task Force generated estimated playback hours based on an analysis of survey data, our knowledge of specific collections, and direct experience with a number of the formats on campus.

Our working assumptions, however, are that not every recording is necessarily a strong candidate for long-term preservation and that not every campus recording will be preserved. Therefore, the subgroup undertook a non-binding research value analysis of campus collections. This high-level analysis identified collections that may *not* be good candidates to provide a ballpark view of resources needed for preservation. For example, several collections of commercial VHS tapes and DVDs that circulate primarily to students were subtracted from our preservation totals. This analysis was considered non-binding because we believe that prioritization decisions must be made with the full involvement of curatorial and/or custodial collection staff. These decisions will be revisited in more detail during the prioritization part of this project.

Preservation Workflows

The Task Force then turned to AVPS to develop specific preservation workflows. These workflows included data on the time required to complete each step in the preservation transfer process for each format, using metrics developed by AVPS from their work with a number of institutional clients, including data from time-motion studies. This enabled us to estimate such things as total labor hours, number of years needed for preservation transfer of each format, and number of items that may be preserved in one day, among others. Workflow tasks were divided into two basic categories: highly skilled engineering (preservation transfer specialist) tasks such as aligning tape machines and manipulating deteriorating recordings, and less skilled technician tasks such as photographing, cleaning, and prepping items.

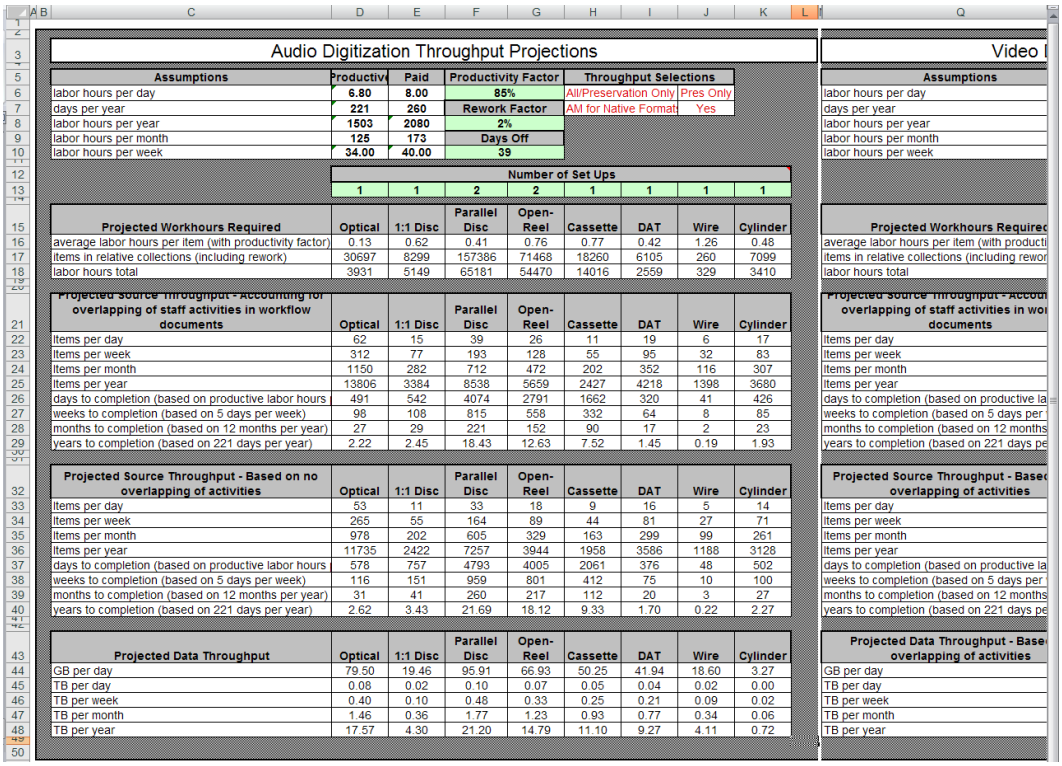
The Task Force subgroup evaluated workflows for appropriateness within the IU Bloomington context, working to define our ideas for preservation transfer work as discussed in the section on the Indiana approach, above. We then re-analyzed each format to estimate the percentage of each that could be handled by a parallel transfer workflow versus a percentage that we felt must be directed to a 1:1 workflow. During this process AVPS developed a sophisticated, interactive set of spreadsheets that allowed us to build and change scenarios at will.

Build Plan

With this information we were able to create a build plan, estimating number/type of staff, number/type of media studios, facility square footage, and digital storage over the life of the project. This plan was presented to the internal Advisory Board, the architectural team working on the project, and IU Bloomington administration during spring semester, 2011.

The two figures below illustrate both the complexity and precision of the data behind the build plan.

Figure 8: Screenshot of Audio Part of Digitization Throughput Spreadsheet



Audio Digitization Throughput Projections

Assumptions	Productiv	Paid	Productivity Factor	Throughput Selections	
labor hours per day	6.80	8.00	85%	All/Preservation Only	Pres Only
days per year	221	260	Rework Factor	AM for Native Formats	Yes
labor hours per year	1503	2080	2%		
labor hours per month	125	173	Days Off		
labor hours per week	34.00	40.00	39		

	Number of Set Ups							
	1	1	2	2	1	1	1	1

Projected Workhours Required	Optical	1:1 Disc	Parallel Disc	Open-Reel	Cassette	DAT	Wire	Cylinder
average labor hours per item (with productivity factor)	0.13	0.62	0.41	0.76	0.77	0.42	1.26	0.48
items in relative collections (including rework)	30697	8299	157386	71468	18260	6105	260	7099
labor hours total	3931	5149	65181	54470	14016	2559	329	3410

Projected Source Throughput - Accounting for overlapping of staff activities in workflow documents	Optical	1:1 Disc	Parallel Disc	Open-Reel	Cassette	DAT	Wire	Cylinder
Items per day	62	15	39	26	11	19	6	17
Items per week	312	77	193	128	55	95	32	83
Items per month	1150	282	712	472	202	352	116	307
Items per year	13806	3384	8538	5659	2427	4218	1398	3680
days to completion (based on productive labor hours	491	542	4074	2791	1662	320	41	426
weeks to completion (based on 5 days per week)	98	108	815	558	332	64	8	85
months to completion (based on 12 months per year)	27	29	221	152	90	17	2	23
years to completion (based on 221 days per year)	2.22	2.45	18.43	12.63	7.52	1.45	0.19	1.93

Projected Source Throughput - Based on no overlapping of activities	Optical	1:1 Disc	Parallel Disc	Open-Reel	Cassette	DAT	Wire	Cylinder
Items per day	53	11	33	18	9	16	5	14
Items per week	265	55	164	89	44	81	27	71
Items per month	978	202	605	329	163	299	99	261
Items per year	11735	2422	7257	3944	1958	3586	1188	3128
days to completion (based on productive labor hours	578	757	4793	4005	2061	376	48	502
weeks to completion (based on 5 days per week)	116	151	959	801	412	75	10	100
months to completion (based on 12 months per year)	31	41	260	217	112	20	3	27
years to completion (based on 221 days per year)	2.62	3.43	21.69	18.12	9.33	1.70	0.22	2.27

Projected Data Throughput	Optical	1:1 Disc	Parallel Disc	Open-Reel	Cassette	DAT	Wire	Cylinder
GB per day	79.50	19.46	95.91	66.93	50.25	41.94	18.60	3.27
TB per day	0.08	0.02	0.10	0.07	0.05	0.04	0.02	0.00
TB per week	0.40	0.10	0.48	0.33	0.25	0.21	0.09	0.02
TB per month	1.46	0.36	1.77	1.23	0.93	0.77	0.34	0.06
TB per year	17.57	4.30	21.20	14.79	11.10	9.27	4.11	0.72

Video

Assumptions
labor hours per day
days per year
labor hours per year
labor hours per month
labor hours per week

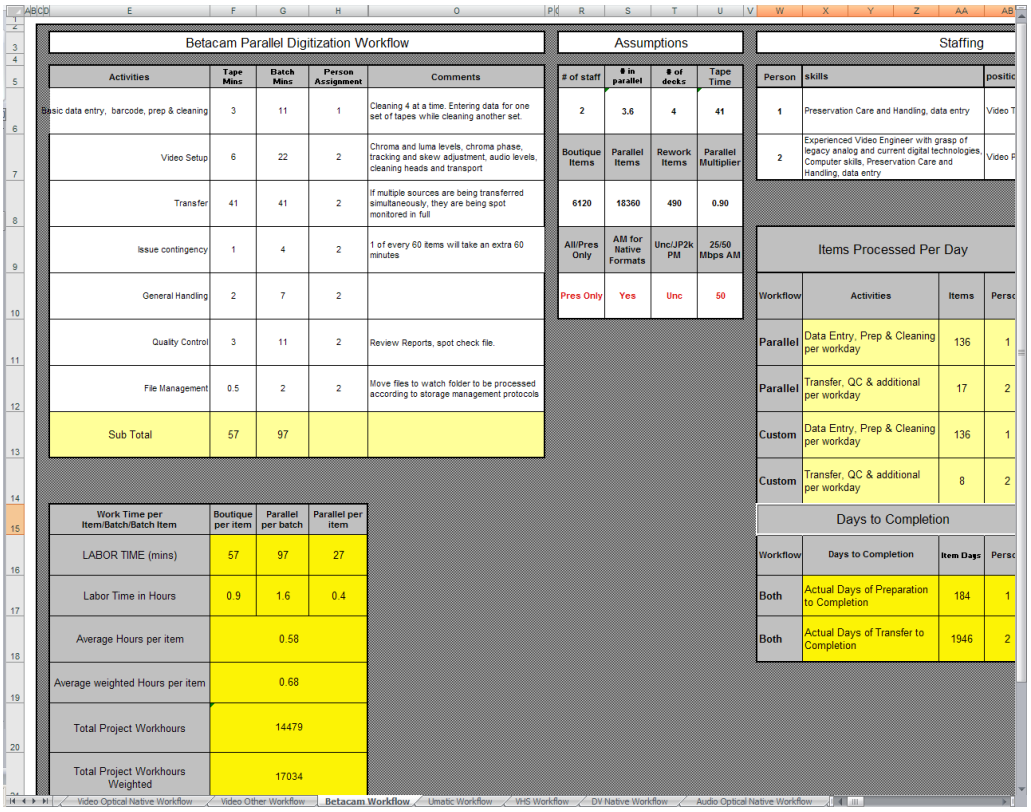
Projected Workhours Required
average labor hours per item (with productivity factor)
items in relative collections (including rework)
labor hours total

Projected Source Throughput - Accounting for overlapping of staff activities in workflow documents
Items per day
Items per week
Items per month
Items per year
days to completion (based on productive labor hours
weeks to completion (based on 5 days per week)
months to completion (based on 12 months per year)
years to completion (based on 221 days per year)

Projected Source Throughput - Based on no overlapping of activities
Items per day
Items per week
Items per month
Items per year
days to completion (based on productive labor hours
weeks to completion (based on 5 days per week)
months to completion (based on 12 months per year)
years to completion (based on 221 days per year)

Projected Data Throughput
GB per day
TB per day
TB per week
TB per month
TB per year

Figure 9: Screenshot of Betacam Digitization Workflow Spreadsheet



Betacam Parallel Digitization Workflow

Activities	Tape Mins	Batch Mins	Person Assignment	Comments
Basic data entry, barcode, prep & cleaning	3	11	1	Cleaning 4 at a time. Entering data for one set of tapes while cleaning another set.
Video Setup	6	22	2	Chroma and luma levels, chroma phase, tracking and skew adjustment, audio levels, cleaning heads and transport
Transfer	41	41	2	If multiple sources are being transferred simultaneously, they are being spot monitored in full
Issue contingency	1	4	2	1 of every 60 items will take an extra 60 minutes
General Handling	2	7	2	
Quality Control	3	11	2	Review Reports, spot check file.
File Management	0.5	2	2	Move files to watch folder to be processed according to storage management protocols
Sub Total	57	97		

Assumptions

# of staff	# in parallel	# of decks	Tape Time
2	3.6	4	41
Boutique Items	Parallel Items	Rework Items	Parallel Multiplier
6120	18360	490	0.90
All/Pres Only	AM for Native Formats	Unc/JP2k PM	25/50 Mbps AM
Pres Only	Yes	Unc	50

Staffing

Person	skills	positic
1	Preservation Care and Handling, data entry	Video T
2	Experienced Video Engineer with grasp of legacy analog and current digital technologies, Computer skills, Preservation Care and Handling, data entry	Video P

Items Processed Per Day

Workflow	Activities	Items	Perso
Parallel	Data Entry, Prep & Cleaning per workday	136	1
Parallel	Transfer, QC & additional per workday	17	2
Custom	Data Entry, Prep & Cleaning per workday	136	1
Custom	Transfer, QC & additional per workday	8	2

Work Time per Item/Batch/Batch Item	Boutique per item	Parallel per batch	Parallel per item
LABOR TIME (mins)	57	97	27
Labor Time in Hours	0.9	1.6	0.4
Average Hours per item	0.58		
Average weighted Hours per item	0.68		
Total Project Workhours	14479		
Total Project Workhours Weighted	17034		

Days to Completion

Workflow	Days to Completion	Item Days	Perso
Both	Actual Days of Preparation to Completion	184	1
Both	Actual Days of Transfer to Completion	1946	2

Video Optical Native Workflow | Video Other Workflow | Betacam Workflow | Umatic Workflow | VHS Workflow | DV Native Workflow | Audio Optical Native Workflow

Facility Staff

The Task Force recommends the following general categories of staff for the Indiana Media Preservation and Access Center:

Transfer Specialists

These positions are experienced audio, video, and film engineers with expert technical knowledge and highly developed critical listening and/or viewing skills. They are responsible for securing optimal playback of deteriorating historical media on obsolete formats, verifying the performance of the transfer signal chain including analog-to-digital conversion, ensuring maximum fidelity from the transfer, documenting the source recording and the digitizing process, and quality control.

The build plan requires the following positions to reach its targets: three audio preservation transfer specialists, three video preservation transfer specialists, and one film transfer specialist. Two of the audio specialists will work a first shift with one working a second shift. We anticipate the same schedule for the video specialists. Note that the planned strategic, phased start to access digitization of film suggests employing one specialist to start but adding a second specialist in three to five years as the technology evolves.

Technicians

Supporting the transfer specialist positions are technicians who prepare items to be digitized, performing tasks such as inspecting, photographing, cleaning, repairing, treating, and documenting recordings. Our data indicates that four technicians are needed to reach build plan targets: two audio/video technicians who support all of the audio and video transfer specialists and one film technician supporting the film transfer specialist. In addition, one technician devoted to performing born digital migration is required. This task requires less technical skill than analog audio, video, and film transfer and fits within the technician position's skill set. One of the audio/video technicians will work the second shift while the others will work the first shift.

Pre- and Post-Processing Staff

Three processing assistants and one quality control technician will have primary responsibility for post-digitization workflow tasks as well as the documentation-related parts of the pre-digitization workflow. This will include intake and registration, data entry, workflow management and tracking, metadata collection and disposition, and quality control.

Maintenance Engineer

Preservation transfer work at the IMPAC will rely upon obsolete legacy playback machines for nearly all audio and video formats. These machines must be regularly maintained, aligned, and repaired to support the best possible playback for these formats. This is no easy task given that some machines may be thirty or more years old with only scarce availability of spare parts. If a key machine or two are down, the impact on the facility's throughput could be immense, particularly if relying upon the schedule of an outside repair person. The Maintenance Engineer will support the entire center with maintenance, repair, and verification of legacy equipment. Task Force visits to the Packard Campus of the Library of Congress and George Blood Audio and Video, including examination of staffing, suggest that this is a full-time position for a facility of the size we recommend.

IT Development and Support Staff

This build plan relies upon automation, particularly of specific tasks in the post-digitization workflow, to reach its targets. This includes creating derivatives, embedding and entering metadata, and copying files to both interim and long-term storage while verifying checksums. It also relies upon efficient metadata collection and generation throughout the entire workflow. These functions are accomplished using software applications that enable greater accuracy and increased speed compared to the same workflow tasks done by hand by people. Similar applications were developed for audio preservation work by the Sound Directions project; however, these must be adapted for video and film as well as scaled up to work in a facility of this size. In addition, tools must be developed to support the ingestion of content and metadata into long-term preservation storage systems as well as to support ongoing processes of verifying data integrity and migrating content to new file and media formats. This will take significant resources, particularly in the early years. The Task Force recommends three software developer/analyst positions with two beginning at least six months before the start of IMPAC operations as discussed in Chapter 8, Technology Infrastructure Analysis and Needs. It may be possible to reassign one or two of these positions as work is completed. However, one of the key things that the Task Force learned from its visits to the Library of Congress as well as George Blood Audio and Video is that ongoing software development, maintenance, and support are essential to the efficient

functioning of facilities of this size. The three programmer positions are detailed in Chapter 8.

The IMPAC will include thirty to forty computer workstations with specialized software, plus storage servers and specialized networking that will require IT support. One IT Local Support Provider (LSP) position is included to provide this support. While physically located at the IMPAC facility, this position would be located organizationally within Library Technologies Core Services to benefit from the support and helpdesk infrastructure provided by an existing IT support organization.

SMART

The Strategic Media Access Resource Team (SMART) consists of graduate students led by an IMPAC staff member. Its purpose is to help units prepare their holdings for digitization. This team is discussed later in this chapter.

Administrative Staff

The Task Force recommends the following positions for IMPAC administration:

1. **Director of Media Preservation and Access**
   This position directs the Indiana Media Preservation and Access Center (IMPAC). The Director educates the campus community and outside constituencies on media preservation issues as well as IU Bloomington media holdings. This position develops collaborations with outside partners, interfaces with researchers and faculty who work with and/or hold media content, and participates with university development staff in fund raising. The director works with campus stakeholders to develop tools that enable access to archival media content and oversees the development of programs that use campus content in both traditional and innovative ways.
2. **Director of Media Preservation Services (DMPS)**
   This position directs the daily work of IMPAC technical staff and maintains collaborative working relationships with campus content holders. The DMPS directs teams engaged in providing preservation services to IU Bloomington units, setting preservation priorities for campus media content, and developing and maintaining efficient preservation workflows including the software applications that support them. The position also directs compliance, quality assurance, and quality control efforts, ensuring that both the input to, and output of, the IMPAC conforms to standards and best practices as well as IU Bloomington preservation procedures.
3. **Media Preservation Specialist (MPS)**
   This position leads the SMART team that helps IU Bloomington units prepare their collections for preservation treatment. The MPS serves as a resource for units, advising them on media preservation issues including physical storage and handling and the implementation of standards and best practices. This position also assists units in prioritizing holdings for preservation including evaluating condition and risk and assessing research value.
4. **Administrative Assistant**
   Although some basic functions such as payroll may be handled by other administrative units, the IMPAC will still need support for a number of clerical tasks.

Below is a diagram that shows all IMPAC staff positions followed by another diagram of positions primarily responsible for digitization activities (including pre- and post-digitization workflow) and their supporting relationships.

Figure 10: IMPAC Organizational Chart

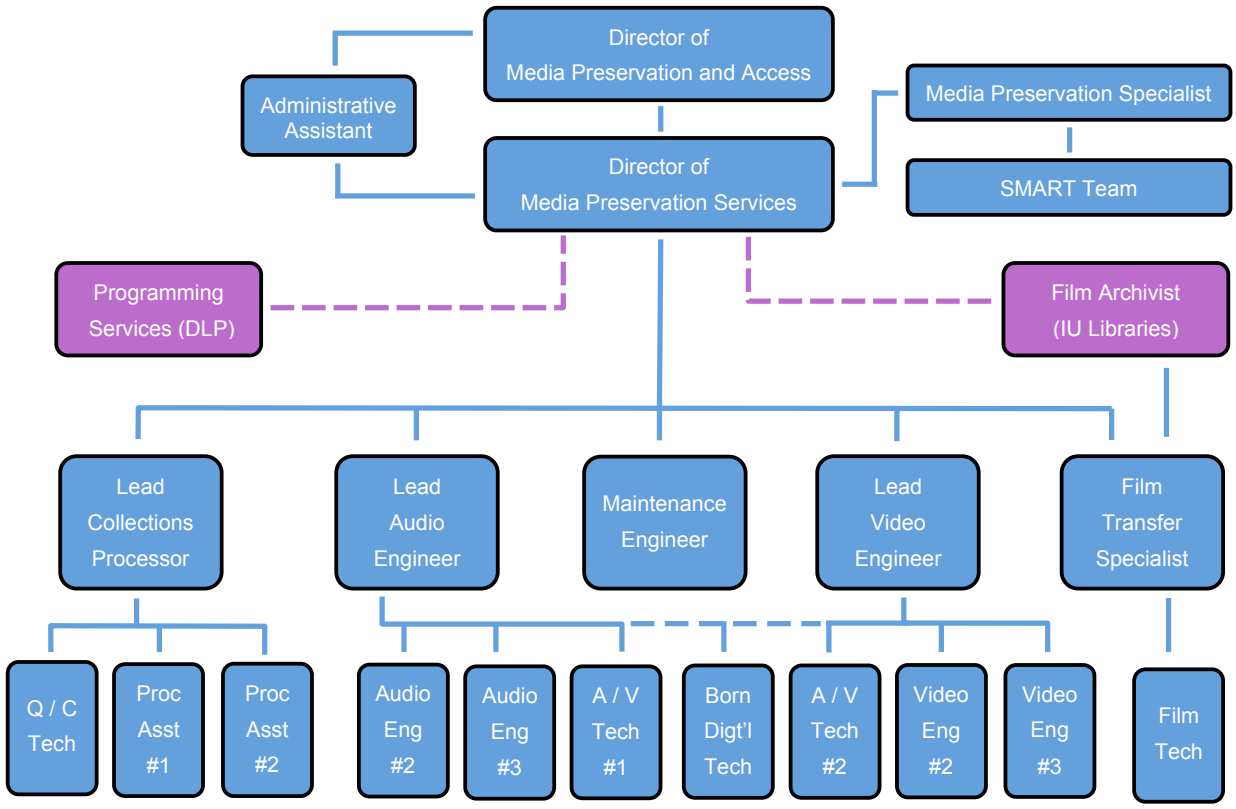
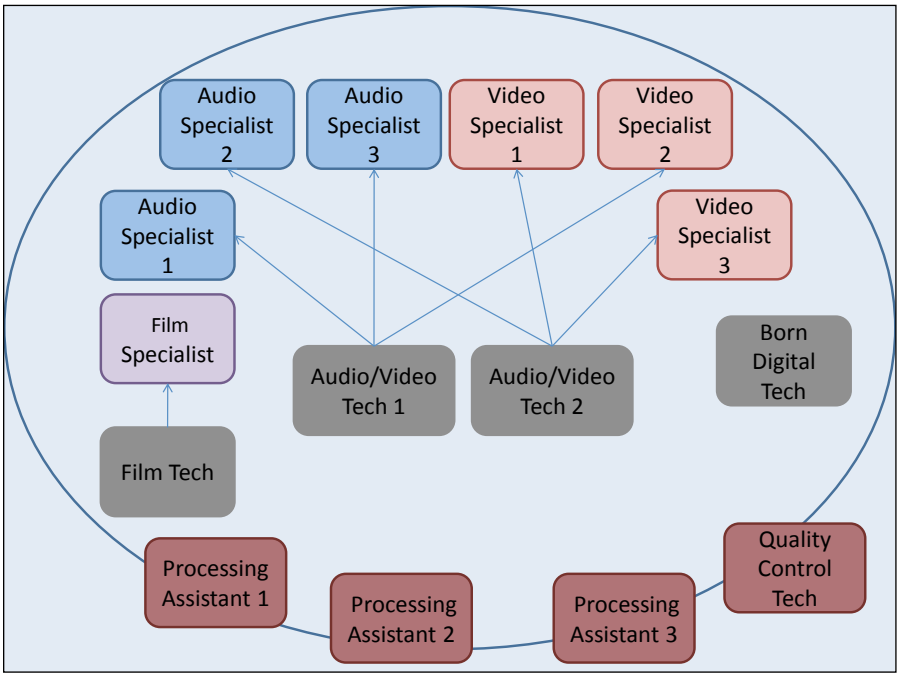


Figure 11: Digitization Positions and Supporting Relationships



Physical Space

Physical space needs for the IMPAC were generated directly from data on campus media formats as well as throughput and staffing projections. In addition, both AVPS and Task Force members used their considerable experience working in and developing media studios to inform physical space choices. The recommendations presented below are tightly bound to the targets in the build plan. Variations will necessarily involve adjusting these targets along with the build plan itself.

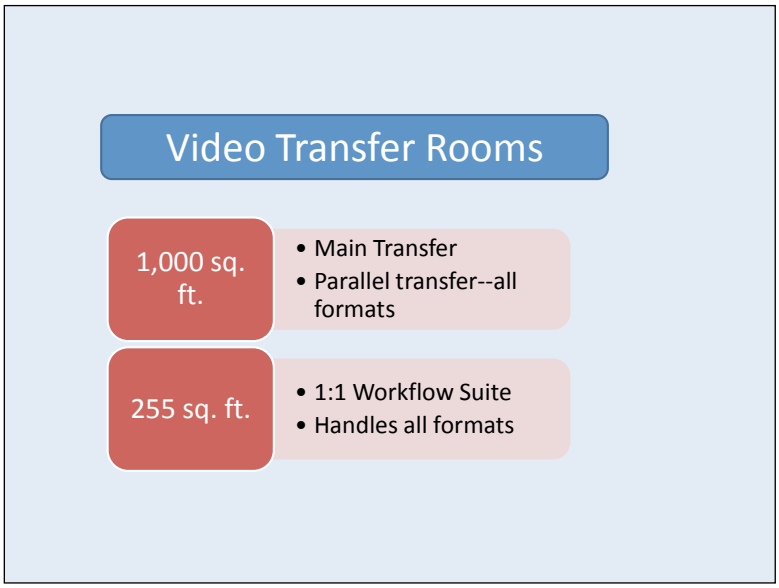
Audio

Figure 12: Audio Transfer Rooms

The audio portion of the center consists of four transfer rooms. The open-reel tape format presents significant challenges due to the size of the holdings and the complexity of the format. The open reel transfer suite is a parallel transfer room capable of digitizing four tapes at a time, and it must be large enough to accommodate eight large open-reel playback machines (two groups of four machines for alternating parallel transfers). This room must be staffed for two shifts to meet project targets. Open-reel tapes requiring a 1:1 workflow will be digitized in the 1:1 workflow transfer suite as will problem items from other formats. This is a critical monitoring room capable of the highest quality audio preservation transfer work. The audiocassette transfer suite will handle parallel transfers of the sizable holdings in this format. Finally, the parallel disc transfer suite will be used for parallel transfers of commercial LPs and commercial 78rpm shellac discs.

Video

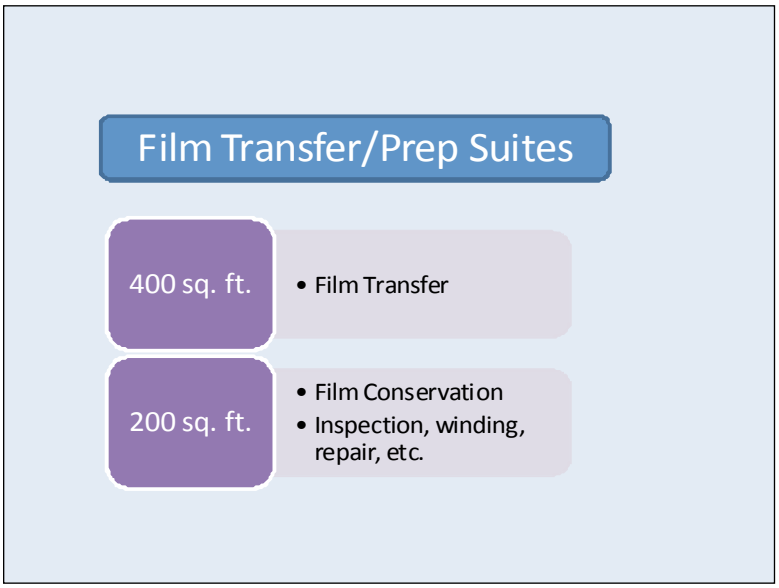
Figure 13: Video Transfer Rooms



The video portion of the center consists of one large parallel transfer suite that handles multiple formats along with a smaller room for problem items that require a 1:1 workflow. The smaller space is a critical monitoring room capable of the highest quality video preservation work. The large main transfer room contains parallel transfer setups for a number of formats, and it must be able to accommodate four playback machines for each as well as four large monitors servicing all setups.

Film

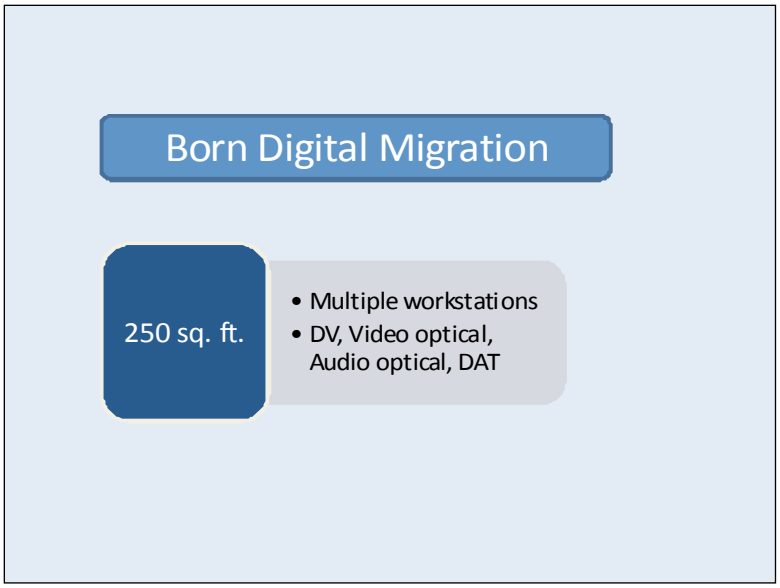
Figure 14: Film Rooms



Access digitization of film will take place in the film transfer suite, which must be large enough to (eventually) hold two digitization workstations. The film technician will work in the conservation suite preparing items for digitization.

Born Digital

Figure 15: Born Digital Room



The born digital room will contain a number of workstations devoted to the data migration of physical digital formats such as CD, DVD, MiniDV, and DAT.

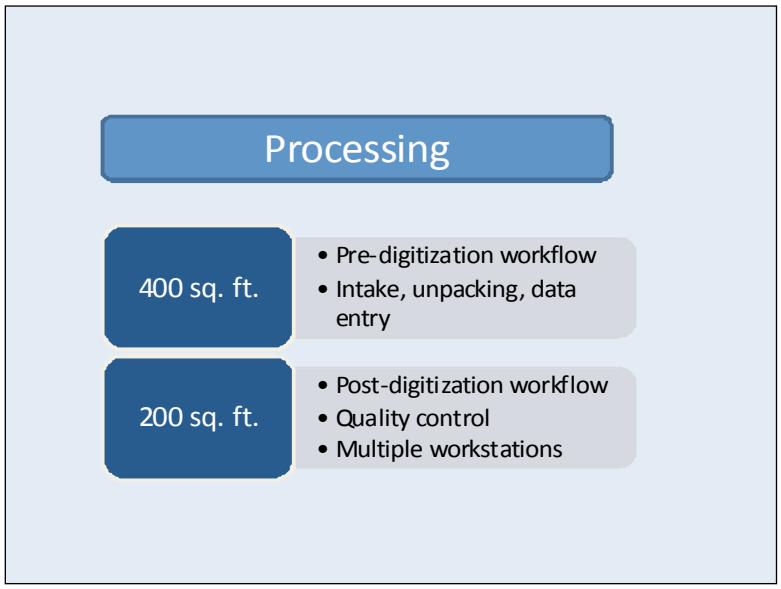
Audio/Video Prep and Repair

Figure 16: Audio/Video Prep and Repair Room

The audio/video prep and repair room will be used by two technicians to prepare recordings for digitization. One technician will work the first shift and the other will work the second shift. This room requires large, flat surfaces for inspecting and repairing numbers of recordings at the same time and must be large enough to also hold a scientific incubator and a record-cleaning machine.

Processing Rooms

Figure 17: Processing Rooms



These rooms will be used by three processing assistants and one quality control technician. The larger room supports pre-digitization activities such as unpacking and ordering recordings, initial visual inspection, and data entry. The smaller room will be used for post-digitization workflow functions, particularly quality control.

Maintenance and Repair Room

This 270-square-foot room is designed for the Maintenance Engineer's repair work on playback machines and other items.

Machine Room

The machine room holds all computer CPUs, amplifiers, and other items from the various transfer rooms. This is standard practice in media studio facilities where noise and heat must both be minimized for successful work.

Storage Rooms

The center will store a significant number of recordings awaiting digitization for which a media storage vault is needed. This space must provide reasonable temperature and relative humidity controls for items that may be on site for weeks or even months as work is completed. Highly problematic items may remain on-site for a longer period of time as difficulties are researched and possible solutions implemented. It may be possible to make use of existing vault space on campus depending on where the center is located.

The center will acquire and maintain backup playback machines as well as machines used for spare parts. Because of rapidly advancing obsolescence issues, it is imperative to stockpile enough machines to last as long as we expect to transfer any given format. Many institutions including the two that the Task Force visited—the Library of Congress and George Blood

Audio and Video—have invested heavily in stockpiling legacy machines to keep their digitization operations moving forward. While this function will take considerable space, it can be provided off-site in a room that is cool and dry.

Administrative Offices

Basic office space is needed for four administrative positions.

Meeting Room

This room is needed for staff meetings, section meetings, as well as meetings with campus stakeholders and interested external parties.

Summary

The table below provides a summary of our recommendations for Indiana Media Preservation and Access Center physical space. Total square footage in this table equals 7,725. Preliminary estimates from architects indicate that adding hallways and other design considerations might increase this to approximately 10,000 square feet.

Table 7: Summary of Indiana Media Preservation and Access Center Rooms

Room name	Activities	Size	Shifts	Type
Audio Open-Reel Transfer Suite	Parallel transfer	400	2	Critical Monitoring Room
Audiocassette Transfer Suite	Parallel transfer	300	1	Non-Critical Monitoring Room
Audio Disc Transfer Suite	Parallel transfer of commercial discs	400	2	Non-Critical Monitoring Room
Audio 1:1 Workflow Transfer Suite	Work that requires critical listening. Includes open reel, audiocassette, disc, wire, cylinder, etc.	400	1	Critical Monitoring Room
Video Main Transfer Room	Video transfers	1,000	2	Non-Critical Monitoring Room
VHS Workstation				
U-matic & Betacam Workstation				
Other Workstation				
Special Setup Workstation				
Video Critical Viewing Suite	Work that requires critical viewing. Includes most formats	255		Critical Monitoring Room
Born Digital Migration	Multiple workstations dedicated to born digital migration. DV, Video Optical, Audio Optical, DAT	250	1	Media Handling
Film Transfer Suite	Film access transfers	400	1	Critical Monitoring Room
Film Conservation Suite	Winding, cleaning, repair. Needs to fit several inspection tables	200	1	Media Handling
Audio/Video Prep/Repair	Inspection, diagnosis, cleaning, baking, lubricating, repair, etc. of audio and video media	650	2	Media Handling
Maintenance/Repair	Working on equipment	270	1	Office
Media Storage Vault	Size dependent on frequency of delivery to/from the lab and whether collections will be sent in part or in whole. Latter allows efficient processing—former requires less space	750		

Equipment Storage Room	Can be off-site if necessary	750		Must be cool and dry
Processing- Intake	Intake, unpacking, barcoding, data entry, placing on carts and taking to media storage	400	1	Media Handling
Processing- Quality Control	Multiple workstations dedicated to quality control. Part of post-digitization workflow	200	2	Media Handling
Machine Room(s)	Quantity depends on layout of rooms	300		Need AC for cooling. Need air filtration
Administrative Office 1	Director of Media Preservation and Access	150		Office
Administrative Office 2	Director of Media Preservation Services	150		Office
Administrative Office 3	Office Assistant	150		Office
Administrative Office 4	Media Preservation Specialist	150		Office
Meeting Room	Staff meetings, meetings with stakeholders	200		Office
	TOTAL SQUARE FEET	**7,725**		

Digital Storage

Using the data that we have generated, the Task Force is able to estimate digital storage needs on a yearly basis and over the life of the project. We are also able to provide throughput projections for daily work. Digital storage needs may vary widely depending upon the underlying assumptions in place. A change in any assumption may result in a significantly lower or higher figure. Current working assumptions under this build plan include the following:

- all targets as presented above
- use of an uncompressed video preservation master file format
- use of a 50 Mbps video production master
- high resolution audio preservation and production masters—24 bit, 96 kHz sample rate
- use of an uncompressed 2K film master
- use of a 50 Mbps film production master

Note that final decisions on the above assumptions have not yet been made.

Under this build plan using the above assumptions, the Task Force estimates that the IMPAC will require 39PB for long-term storage of one copy of preserved content over the fifteen-year time period. We project needing approximately 2-3PBs of storage each year once production is

in full swing. The center will also require secure interim storage for digital files awaiting processing before they are moved to long-term storage. Storage plans are detailed in the chapter on technology infrastructure.

Excess Capacity

The center will operate two shifts in some rooms and one shift in others. Note that the third shift in a work day is needed for automated data processing and transmission using software applications. Empty rooms during the second shift provide excess physical capacity that may be used to expand the center's operations. The facility could, for example, use this capacity to take outside work from CIC institutions or from IU faculty. Additional personnel would be required as there is no excess staffing capacity under this build plan. The following rooms are available for additional work during a second shift:

- Audiocassette
- Audio 1:1
- Video 1:1
- Video Main—some setups
- Born Digital Migration
- Film
- Audio/Video Prep—shared
- Film Prep
- Processing—Intake
- Processing-QC

IMPAC Audio and Video Preservation Workflow Functions

Key Points

This section focuses on details of pre- and post-digitization workflow to define Indiana Media Preservation and Access Center responsibilities and relationships with units.

A Strategic Media Access Resource Team (SMART) composed of student workers led by center staff will help units prepare for digitization.

Basic descriptive metadata only will be collected so that digitization is not slowed or halted. Full description will be the responsibility of the originating unit.

A rich set of administrative metadata will be collected to support interpretation and management of digital objects.

Software applications or scripts are necessary to automate post-digitization tasks that can be accomplished faster and more accurately than if done by humans.

In this section the Task Force explores workflow functions at the proposed center in order to further define our approach, responsibilities, and relationship with media holding units, especially in the pre- and post-digitization stages of the workflow.

Pre-digitization

1. **SMART team works with units**

   The Strategic Media Access Resource Team (SMART) will be composed of graduate students led by a center staff member. Its purpose is to help units prepare their holdings for digitization. This work will focus on gaining basic physical and intellectual control including tasks such as assigning unique numbers, adding barcodes, gathering basic descriptive and technical identifying information, locating copies and accompanying documentation if they exist, packing, and transporting recordings. The team will also assist units with basic digitization decisions such as developing a digital file-naming scheme. Units will vary in terms of the amount and type of help they require and resources they have available for this work.

2. **Collect metadata**

   The External Advisory Board recommended in the strongest terms that we focus on minimal descriptive metadata only—just enough to track items through the digitization workflow and match digital files to objects. Full cataloging or creation of finding aids, both of which are time consuming, can follow later and, in fact, may be easier and more accurate once digital files are available to reference the content. The board's experience suggests it is critical to not let detailed description slow down or halt digitization.

   We anticipate that basic description will consist of the following elements only:

format, unit with custody, shelf number, collection number or title, recording title or one-phrase description, and digitization center storage location. Barcodes are for inventory control, quality control, and efficiency throughout digitization center workflow but are also required if final storage is in ALF. Many units will have already assigned shelf or call numbers to individual recordings. These will be used by the center in filenames and a workflow database and by the units in collection documentation

3. **Register incoming items**
   This is the Center's intake function where recordings are unpacked and inspected, data entry into a workflow database is initiated (or checked if already done by the SMART team), receipt is acknowledged with the sending unit, and items are shelved.

4. **Schedule digitization**

5. **Develop collection digitization plan**
   In this stage, the center technical team reviews collection, discusses potential problems, and develops overall approach for transfer of specific collection. This meeting includes engineers, technicians, processing assistants, and management staff.

6. **Preliminary transfers and quality control**
   This workflow step features digitization of the first three to five recordings of a collection and basic technical metadata entry followed by intensive quality control. This step tests the collection digitization plan and catches problems and errors early in the digitization process.

7. **Create default technical metadata records**
   In this step, default technical metadata records for the collection are created for use by both transfer and post-digitization processing staff. An existing standards-based audio metadata collection software application named the Audio Technical Metadata Collector (ATMC) will be expanded to include video and film formats and will be used by the center for technical, digital provenance, and some structural metadata. ATMC, which provides for both manual and automated collection of metadata, was developed by the Sound Directions project at IU and is supported by the Digital Library Program.

Digitization

In addition to the expected engineering tasks related to digitization, this stage includes the following:

1. **Visual inspection**
   A technician inspects recordings to route to a parallel transfer or a custom 1:1 workflow.

2. **Photograph recordings, boxes, sleeves, and labels**
   Boxes, sleeves, and labels often contain important metadata that must be made available to researchers, preferably in a form as close to the original as possible. In

addition, photographs of recordings with degradation are useful to researchers accessing and interpreting content online. In a more abstract way, we believe that photographs of recordings bring researchers closer to the original objects and will prove to be a desired feature. Therefore, the Task Force thinks it is highly desirable to present online researchers with images of the object and its container along with the audio or moving image stream.

Photographic work is the responsibility of the technician at this stage of the workflow so that items are handled just once by a trained person. For routine items with no visible degradation —an estimated 90 percent of the total—a quick, one-size-fits-all approach will be used with preset lights and camera set-up. For items with visible degradation, photographing the recording requires special lighting and angles to capture signs of degradation.

3. **Re-house recordings as needed**

4. **Stabilization and Preparation**
   Cleaning, baking, repairs, and other work carried out by the engineer or technician as appropriate.

Post-digitization

The tasks below are undertaken by collection processing assistants. Automated scripts will run every night to create derivatives, embed metadata into files, enter metadata into ATMC, copy files to storage and regenerate checksums, and other tasks.

- Perform quality control of engineer metadata entry.
- Approve files and metadata for script.
- Spot-check products of script.
- Process highly problematic items manually.
- Return recordings to unit and/or permanent storage location.
- Trigger creation of preservation package for ingest into preservation repository.
- Approve preservation package for ingest.
- Delete files from IMPAC storage.

Task Force Recommendations

18. Build the Indiana Media Preservation and Access Center to efficiently and cost-effectively preserve IU Bloomington holdings.
19. Explore the feasibility of using second-shift excess capacity to provide services to other institutions and/or IU faculty.
20. Form a Strategic Media Access Resource Team (SMART) made up of graduate students supervised by IMPAC staff to help IU Bloomington units prepare holdings for digitization.
21. Collect a minimal set of descriptive metadata to support an efficient digitization workflow. Support later work on full description, including cataloging and the development of finding aids, by making digital files of preserved content available to catalogers and/or other unit staff.
22. Collect a rich set of technical metadata to fully support future interpretation and management of digital content. Support the rapid development of the software application ATMC for this purpose.
23. Develop an IMPAC quality assurance and quality control plan.

7 Access

Key Points

Access to preserved holdings is critical to the success of the IMPAC and to the realization of its value to the campus.

Access vision: In the next five years, Indiana University Bloomington will be a recognized leader among other universities in the systematic preservation and access to its time-based media holdings.

A set of access principles outline a basis for future work:

- Curatorial units will remain the primary locus for access decisions.
- Access work will follow standards and best practices.
- Media will be made as discoverable and deliverable online as legal and ethical standards permit.
- Media access infrastructure is a basic need.
- Discovery will employ multiple strategies.
- Metadata records should only be created once.
- IU will explore legal avenues for broad online access.
- Rights management tools are needed.
- Access efficiencies are necessary.
- Administrative metadata support is needed.
- Access digitizing must be evaluated in relation to cost/benefits of preservation.
- The IMPAC will support timely fulfillment of access requests.
- Derivative quality must suit user needs.
- IMPAC will partner with DLP for long-term derivative creation.
- Centralized object and collection management should be explored.

IU Bloomington has developed components for media access but additional work and development are needed to create an integrated system.

Barriers to archival media discovery, delivery, and use remain significant for instructors and researchers.

DLP proposes to develop a system code-named Variations on Video that would serve as a baseline discovery, delivery, and access system for media collections digitized as part of the MPI. This is dependent on grant funding.

Overview

The holdings of Indiana University are preserved so that they may be accessible and provide for a variety of uses into the foreseeable future. Preservation efforts support the core missions of research, instruction, curation, and public availability. Access, broadly defined, includes the discoverability, the deliverability, and the usability of any given media item. How do users find the items? How do they view and listen to them? How is use controlled to comply with ethical guidelines and laws designed to protect people and intellectual property? These questions are at the heart of what we mean by "access."

To address these questions, and to define the most urgent issues in this area, the Task Force convened a series of meetings with special collections representatives and focused on these topics in a succession of its own sessions. This work resulted in the creation of a set of guiding principles to serve as a foundation for the development of specific policies and procedures in the future. The next step will be the formation of a working group in 2011-2012 that will focus on access issues and develop a set of detailed recommendations for putting the access principles into action. Key issues this group will engage include rights management, metadata policies and systems, infrastructure needs, curatorial policies, development and hiring recommendations, and collection management. User studies that have recently been conducted as part of the Variations project and the Sound Directions project will also be evaluated for their recommendations on how access development on campus should proceed.

We live in a watershed moment in which acute challenges demand a coordinated effort to address dramatic technological and cultural changes in the way users access time-based media.

Neither media preservation nor media access are new endeavors at Indiana University Bloomington. In both areas, Indiana University has a history of innovation and development that has been a model for other institutions. The Audio-Visual Center produced one of the first educational radio programs in the early 1940s; IU Bloomington maintained one of the largest educational film collections in the United States up until the 1990s; the Sound Directions project is recognized internationally for its work on best practices for digital audio preservation; and the Variations project has been a pathbreaking system for online audio collections access that is now used by other libraries in the United States.

However, we live in a watershed moment in which acute challenges demand a coordinated effort to address dramatic technological and cultural changes in the way users access time-based media. Innovations in digital technologies have driven both analog and digital recording/playback technologies into obsolescence at an alarmingly fast rate. At the same time, the expectations of users for the ways in which they find and experience media has also dramatically changed. Today we take for granted the ability to immediately search millions of media files on YouTube or iTunes and easily select items for playback or purchase. We can store our personal media in a "cloud" service that is available to us wherever we have a connection, and we can be connected almost everywhere through smartphone technologies. These technological innovations are part of the fabric of life in many parts of the world, and yet they have all happened within the last ten years or less. Universities and libraries have struggled to keep up with this rate of change and innovation relative to their own services. IU Bloomington will need to devote additional personnel and resources to the development of

solutions that will maximize the impact of its research collections, and it is particularly well placed to do so. With large and rich collections of media as a reservoir of content, and with a technology infrastructure that rates among the best in the country, this campus is in an excellent position to meet its own challenges and provide a model for access to media resources and collections.

Guiding Access Principles

The mission of the Indiana Media Preservation and Access Center (IMPAC) is to preserve the time-based media holdings of Indiana University so that they may be accessible. Subsequent access to preserved holdings is critical to the success of IMPAC and to the realization of its value to the campus. The work of providing access to preserved original media objects falls under the purview of the repository of record in charge of their archival management. Access to the digital manifestations derived from these time-based media objects, however, will require well-designed partnerships and collaboration across a variety of campus units and stakeholders. To be successful, media preservation plans depend on an integrated solution for media access that will serve users well beyond those who wish to access media that the IMPAC has digitally preserved. To that end, the Task Force has developed a set of guiding principles to define core assumptions about the relationship of the IMPAC to access work and the direction of media access development on campus. The following vision statement sets forth an overall goal for media access, and the statement of access principles outlines a basic understanding between the primary stakeholders and units involved in the implementation of the IMPAC. These principles should be seen as a companion to the preservation principles outlined in Chapter 4.

Media Access Vision Statement

In the next five years, Indiana University Bloomington will be a recognized leader among other universities in the systematic preservation and access to its time-based media holdings. By providing support for the discovery, delivery, and use of its various time-based media holdings in a way that is legal and ethical, extensive and extensible, efficient and easy to use, IU Bloomington will serve as a model for research and educational resource stewardship on campus and around the world.

Media Access Principles

Principle 1: Curatorial Responsibility

Even with centralized preservation services, curatorial units and repositories of record must continue to provide expertise for the purposes of determining value, collection development, public presentation and edification, reference support, collection accessioning and organization, and access management according to appropriate legal and ethical considerations.

The management of special collections depends upon curatorial expertise within a variety of units. Despite the centralization of digital preservation services and the relocation of storage, items and collections must be stewarded by a curatorial unit such as a library, an archive, a department, or a special collection. While long-term stewardship will depend upon integral services and infrastructure provided by the university, and while ownership may reside with the Trustees of Indiana University, curatorial units will be expected to continue to make decisions or enforce agreements about the accessibility of their holdings.

Principle 2: Standards and Best Practices

Access-related production by the IMPAC will follow library and archival standards and best practices for discovery, delivery, and usability of media objects and supporting documentation.

The use of international standards and best practices help ensure that access work is high quality, sustainable, and interoperable. In addition, it provides a technical and ethical foundation upon which to make access decisions as well as encourage choices that support broad accessibility. Staff attendance and involvement in national and international organizations that develop these best practices is the primary means to ensure knowledge of current practices.

Principle 3: Online Accessibility

Media will be made as discoverable and deliverable online as legal and ethical standards permit.

Collections and objects are acquired by the university so that they may be accessible. While there are legal, ethical, and economical reasons to restrict access to certain recordings at certain times, holdings should be accessible in some fashion. Open access to the IU Bloomington community (and beyond when possible) should be the presumed state of the media preserved by IMPAC, but systems and policies will need to be put in place so that access can be controlled in accord with legal requirements and ethical standards.

Standard expectations and practices for media access have changed dramatically in the last ten years. Web and scholarly search engines, discipline- and format-based portals, library-provided discovery environments, archival finding aids, and other online tools are becoming increasingly significant for researchers. IU Bloomington should take advantage of the variety of ways in which media items can be discovered with online systems. As for delivery, the standard expectation for media access is now online delivery. Our underlying assumption is that media will be available online in some form with accommodation for curatorial controls to protect intellectual property, subject privacy, cultural sensitivities, and deposit agreements.

Principle 4: Infrastructure Support

Access to university media holdings is a basic function of their existence. While that access may be controlled in significant ways, the university collects and preserves research and historical documentation so that it may serve research, instruction, and general interest. University infrastructure supports the preservation of and access to those holdings.

In the same way the university provides infrastructure that supports access to published materials, special collections and archival holdings have needs for storage and access infrastructure. The university already supports a large central library as well as a diversity of small, specialized libraries through a common infrastructure. This model can be applied to media holdings as well.

Principle 5: Description and Cataloging Services

IU Bloomington will use a variety of means to enable the discovery of collections and objects, including a unified IU media collections portal, web search engines, and existing discovery tools such as IUCAT and individual unit websites.

Curatorial units and repositories with time-based media currently use a number of different

methods to describe their collections. Discovery of media materials owned by the IU Libraries, for example, is performed through the use of item- and/or collection-level machine-readable cataloging (MARC) bibliographic records via its online catalog, IUCAT, and through the creation of Encoded Archival Description (EAD) finding aids that supply more information for archival collections beyond what can be provided by traditional MARC records. While finding aids of various kinds and other databases exist at IU Bloomington units, few are easily viewed online. A broad strategy that incorporates a mixture of standards-based solutions is a viable way to move forward with better discovery services for media holdings at IU Bloomington.

Media collections on campus are understaffed relative to the discovery needs of their unit, and the preservation work of the IMPAC will make these needs more acute. It will be important to provide new positions for discovery in the form of catalogers and consultation services to units wishing to learn more about practices such as media cataloging or creating standards-based finding aids. In addition, the access system should be able to accommodate existing standards-based descriptive practices in use at IU Bloomington.

Principle 6: Singularity of Records

Metadata created by the IMPAC and associated with discovery and management must be easily exportable, importable, or readable across IU discovery systems so that such records have to be created only once.

In an effort to accommodate the variety of databases and discovery systems within units, there is a risk that the IMPAC or unit catalogers and indexers will duplicate efforts. Units need support in integrating any idiosyncratic or localized solutions into a standards-based database for managing metadata. At the same time, units will need to participate in adapting metadata practices so that they align with standards-based solutions.

Principle 7: Copyright Strategies

All laws regarding copyright must be followed. As an educational and research institution, Indiana University will exercise all due diligence in serving its students, employees, and the general public within the accommodations made by copyright laws for research, educational, library, and archival uses of copyrighted materials.

The university must balance its mission to provide access to its holdings with legal and ethical restrictions on certain kinds of access. Delivery and usability of time-based media falls within a contested and constantly evolving legal landscape. IU Bloomington must be proactive in advancing its mission and its commitment to access while at the same time abiding by legal and ethical constraints.

Principle 8: Rights Management Tools

Centralized tools for rights management with the ability to associate rights and access information with items or collections must be available to curatorial units.

The process of providing access to media collections at IU Bloomington necessarily includes an analysis of rights issues and documentation of decisions that govern access. Unit staff will lead this work, but units need a system for rights management that is consistent with campus policies and that allows for easy regulation of delivery. Rights management needs to accommodate a variety of levels of access. Currently, most units with media holdings manage their usability decisions with a system that groups holdings into broad categories of access

rights or on a case-by-case basis. A system that allows quick and, in some cases, automated clearances of rights and access to items is critical to serving the scale of media holdings on campus.

Increased discoverability will increase the demand for commercial and educational use and licensing of content owned or stewarded by Indiana University. Not only does the university need to protect itself from legal risks associated with licensing activity, it can realize financial benefits from the investments it has made in the preservation, documentation, and curation of media holdings. While we do not expect full cost recovery, income can offset portions of the cost of preservation. Because some clients will request copies for production activities, it is in the best interests of Indiana University to streamline the process of fulfilling and managing these requests. Curatorial units will share in these dividends and be responsible for dispersing royalties as their agreements and professional ethics indicate.

It is important that supporting metadata systems allow for fine-grained control of access in both legal and ethical terms so that curators can easily designate and update delivery constraints and conditions, and users can have items they have requested, licensed, or purchased made available in an automated fashion, enabling curators to focus on those items for which automated access is not appropriate. Permission requests for use of content that is not available online should be centrally managed to create some efficiencies and also to facilitate a timely response by curators and archivists.

Principle 9: Automation and Efficiency

Delivery and usability will be automated to a degree that is feasible and acceptable by curatorial units.

The size and scope of the current and future holdings of Indiana University Bloomington makes delivery and use too large to manage on a case-by-case basis. Therefore delivery and usability decisions will be automated to as great a degree as possible. The format of deliverables will be different depending on the needs of the client, but the IMPAC can serve a core set of clients with a system that can automatically deliver digital files using systems such as streaming media or the Slashtmp service within the IU Bloomington infrastructure. These clients might be individual researchers or special collections units on campus. The creation of derivatives for delivery can be automated as well. Centralized management of permissions can also create efficiencies.

Principle 10: Unit and Individual Collection Management Support

To foster long-term management and use, the university must support the collection of a rich set of administrative metadata about digital media objects held by the university as well as those that are part of ongoing faculty research.

Different media objects or collections will require different access controls and guidelines. In addition, as born-digital content becomes a more prominent part of the preservation needs and services provided through the IMPAC, individuals as well as units will need support for managing access to their digital products. For example, scholars may deposit their born digital media to safeguard it, but want to constrain access for personal use only while they prepare a publication. They may need to share it with a few collaborators as well as associate the media with their publications, all without allowing general unrestricted access to the world. Another scholar or production unit may need to provide access only to the subject of the media in order to verify permissions and access agreements with the individual who has been recorded.

These tools will be important for the transition of born-digital media from working objects of research to archival objects for use by other researchers and instructors.

Principle 11: Access Digitizing and Preservation

When digitizing for access purposes only, transfers made by the IMPAC will be to the highest standards feasible using trained staff. All access digitizing[34] will be evaluated in relation to the cost/benefits of preservation digitizing. Whenever it is possible in terms of workflow, timeframe, and costs, digitizing to fill media delivery requests will follow preservation practices.

Access digitizing of analog objects is typically not held to the same standards as preservation transfers, but for the sake of the research and instructional usability, deliverables for access should be created by trained staff to the highest quality feasible. This implies that while digital transfers for access may not be made by an engineer, they will be performed by staff who are carefully trained. Because the window of time for media preservation is so brief and the handling of most objects for processing of any kind involves a significant investment of resources, the IMPAC will make general determinations according to format about the cost/benefit of access digitizing vs. preservation digitizing. Within the framework of preservation prioritization, a request for a media item indicates use and thus raises the value of the item on a prioritization scale for preservation.

Principle 12: Timeliness of Delivery

IMPAC staff will endeavor to respond to access requests and make copies of original media available in a reasonable time frame except in instances where preservation issues and media fragility require delayed access to properly address the care of the original recording.

The IMPAC is a provider of derivatives and access digitizing for units whose holdings it serves. By centralizing the creation of digital copies for access, the center can realize cost savings across campus and provide better service than most units can provide currently. The success of the IMPAC as an access provider will depend on its ability to do this work quickly in the service of special collections, researchers, and instructors, both locally and outside of the university. A system that enables automated production and delivery of requested derivatives can enable very fast service times for users.

Principle 13. Derivative Quality and Access

The university must endeavor to serve the specialized needs of researchers through high-quality derivatives as well as serve an international public that may have access only through poor-quality networks.

High-quality media on a high-speed network allows for maximum research possibilities, while low-quality deliverables for low-speed networks increase delivery options outside of the university in marginal technology areas without access to a high-quality technology infrastructure. To best fulfill our mission as a university, our online media delivery needs to accommodate a wide range of capabilities.

[34] "Access digitizing" is the digitizing of any media asset primarily for the purpose of providing access with minor regard for long-term preservation. Presumably, with preservation standards and controls removed, access digitizing can be performed more quickly and less expensively than preservation digitizing, but it risks creating files that do not meet the quality standards for preservation.

Principle 14. Derivative Management

The IMPAC will be a partner with the Digital Library Program in the long-term management of derivatives.

The Digital Library Program will be responsible for determining appropriate derivative formats for online delivery within a library-managed system. The IMPAC will be responsible for the creation of derivatives for those objects within the system for which preservation master files exist. The IMPAC and the DLP will work together to make decisions about wide-scale derivative format changes within the library-managed system(s).

Principle 15. Object and Collection Management

Centralized solutions for collection and object management will be pursued by the IMPAC in collaboration with the DLP and special collections.

Our planning process identified a need and an interest among special collections for services supporting a physical and digital object collection management system for their holdings. While cautioning that each unit has unique needs, they expressed a desire to find ways in which they could delineate common ground for improved management of their holdings. No special collections unit on campus uses an object or collections management system to any significant degree. The largest media-holding units use MARC record cataloging for holdings, and then rely on local systems for inventory, indexing, and finding aids. Since collections will continue to grow and will be increasingly born-digital, it is in the best interest of all stakeholders to find an enterprise-wide solution that centralizes collection management and allows units to address the unique needs of their holdings and the research communities they serve. Long-term goals include the ability to associate all manner of collection objects (media, images, text, etc.) with each other and make digital representations available to users.

Existing Online Access Solutions at IU

In the last several years, IU Bloomington has developed solutions for providing online access to digital media collections, mostly through grant projects led by or collaborating with the Digital Library Program. Efforts such as Variations for audio and the EVIA Digital Archive Project for video have been groundbreaking and full-featured.

The Variations system provides online access to sound recordings and musical scores, primarily from the Cook Music Library's collections, along with tools to support annotation and pedagogical use of these materials. Variations was originally developed with support from IBM in the mid-1990s. Subsequent funding from NSF, NEH, and IMLS led to its release in 2009 as free, open-source software. Variations is currently in production use at more than ten other colleges and universities beyond IU. At IU, Variations is jointly supported by the Digital Library Program and Cook Music Library. Variations is presently an access system and does not focus on services for preservation. Because most of the materials made available through Variations are commercial recordings protected by copyright, most of the 37,465 recordings currently in the Variations system can only be accessed by physically visiting the Cook Music Library. Additionally, students registered for a course with course reserves in the Variations system can access items in Variations from anywhere they have an internet connection.

The EVIA Digital Archive, developed with support from the Andrew W. Mellon Foundation, provides access to ethnographic video contributed by a variety of scholars and has developed

tools for video access and annotation in use by several other projects at IU, including the Kelley School of Business Global Leaders Network, Cultural and Linguistic Archive of Mesoamerica (CLAMA), and the Archives of Historical and Ethnographic Yiddish Memories (AHEYM). Many of the tools developed by EVIA, including the Annotator's Workbench desktop video annotation tool, are planned for release as open-source software in the near future. These tools are currently supported by the Institute for Digital Arts and Humanities (IDAH) and DLP. The EVIA Digital Archive Project represents an extension of basic discovery and delivery to discipline area support tools for research and instruction, supporting extensive annotation and peer review of media documentation. Video made available through the online Search and Browse tool of the EVIA Project is relatively small at present—only 80 hours—with another 1,200 hours in process.

The DLP Video Streaming Service is supported by the Digital Library Program as a simple means for libraries and archives at IU to provide either open or campus-restricted online access to digital video content. The service is currently in use by Media & Reserve Services in Wells Library, the Libraries Film Archivist, and IU ScholarWorks. This service, like EVIA, is built on top of the streaming server infrastructure maintained by the Video Infrastructure group in UITS Enterprise Systems.

The Ethnomusicology Multimedia project of Indiana University Press is a partnership with Kent State University Press and Temple University Press, with funding from the Mellon Foundation. The project is working with IDAH/DLP on the development of an online Annotation Management Service to support web-based annotation of streaming video. This tool is being developed such that it can be applied to the video annotation needs of other projects in the future. As a collaboration between university presses, the Archives of Traditional Music, and the IU Libraries, this project demonstrates how archival media can be connected to products of research such as books and articles. The project is still in its early phase, and the online site supporting media clips associated with publications of these presses will not be available until the fall of 2011.

Media Access Challenges

Barriers to media access can exist at the point of discovery, delivery, or usability, whether the item is circulating or non-circulating. Patrons attempting to access non-circulating archival holdings are especially likely to encounter barriers of various kinds. Archival holdings may not be well-described, access copies (if they exist) may be in an obsolete format, or copyright or ethical conditions may allow the item's use for research but not for publication. Eliminating unnecessary barriers to access is important to the fulfillment of the work of preservation.

The landscape for time-based media access has changed dramatically in the last five years and continues to change rapidly. Indiana University Bloomington has been innovative in the area of media access through projects such as Variations and the EVIA Digital Archive project. IU Bloomington has not yet integrated the pieces of its powerful technology infrastructure, however, to provide general access to media collections on campus. It is a significant task and few other universities are in a position to provide these services. The size and value of IU Bloomington media holdings warrants the devotion of resources to bring together the pieces of the IU infrastructure in the service of preservation and access.

Recent efforts at other institutions indicate that historic media collections can generate significant interest from the general public. Consider the Library of Congress National Jukebox project, which was launched in May of 2011 with just over 10,000 audio recordings that were made by the Victor Talking Machine Company between 1901 and 1925. In less than

two months, the site has had more than 390,000 visitors.[35] It would be easy to dismiss this content as esoteric and only of interest to specialists, but clearly there is sizable interest among the general public, too. We can assume at the very least that media holdings at IU Bloomington will get more use once they are preserved and made more readily accessible.

Media collections may be accessed in several different ways, depending on the kind of collection. If the holdings circulate like other library materials, then they are likely to be cataloged and easily found through IUCAT. If the materials are not very old, then the patron can check out the item and view or listen to it with a personal laptop or in playback stations in the facility. Many of the holdings of the Library and Music Library fall into this category and they represent a significant portion of the media holdings on campus. Older circulating media such as U-matic video recordings present playback challenges due to obsolescence and may not be immediately available for use. From a preservation point of view, some of these holdings are now out-of-print or will be once the carriers they exist on become obsolete in the next few years, and these will be candidates for digital preservation by the IMPAC. However, some that are commercial releases, which will continue to be widely available in new formats at a cost that is lower than digital preservation, will not be good candidates for digital preservation.

Holdings that are archival in nature—often rare and sometimes unique—present challenges to potential users that are different from most commercial holdings. At present, those challenges act as barriers to use. Archival materials do not circulate and must be copied to be used. Units like the Jacobs School of Music and the Archives of Traditional Music have been making access copies for long enough that they have significant numbers on formats like open-reel tape, audio cassettes, and VHS. These formats are used on a regular basis but require the unit to maintain legacy equipment. Access copies in legacy formats are almost entirely unavailable for classroom use because the necessary equipment is no longer supported in classrooms.

Archival media holdings often exist in collections rather than as single items and, when cataloged, are more likely to have a catalog record for a collection of objects. These objects may be a mixture of recorded media, paper documents, photographs, and sometimes even physical artifacts that are all related in some way. Some collections contain just a few objects, and others contain hundreds. They vary greatly in the way they are organized and documented, resisting standardizing by archivists and librarians. For this reason they are typically cataloged at a collection level with individual objects in the collection described by indexes or finding aids created by the archive. Of course, because archival holdings are likely to be rare or unique, catalogers cannot rely on copy-catalog records created at other institutions. It is typical for archives to have a large "frontlog" of uncataloged holdings.

As we move to delivering media content online—the most efficient way to provide access to a wide range of users—copyright laws and ethical conditions can be significant barriers to access. Clearly, there are good reasons for both copyright laws and ethical standards, but in many cases their application to the conditions of access are unclear. How far can Fair Use be applied? How should we interpret a contract for access that was made with a depositor and with subjects before the Internet was conceived? These questions must be answered both generally and specifically for collections or items as library and special collections make more of their holdings available online. Special collections representatives have identified rights management support as one of their most critical needs.

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[35] "Sound Recordings: The Sound of Silence," *The Economist.* Babbage blog. June 21, 2011. http://www.economist.com/node/21522124

DLP Strategic Directions for Audio/Video Access

Based on requests from within IU as well as from external users and potential users of Variations, the Digital Library Program began an investigation in 2010 into the online media delivery needs of university-based libraries and archives. With support from a planning grant from IMLS, the DLP convened a group of institutions to contribute usage scenarios and discuss requirements and potential architectures. This effort led to the development of a full National Leadership Grant proposal submitted to IMLS by IU in partnership with Northwestern University in February 2011 to develop an online video collection management and access system, currently code-named Variations on Video (VoV). Several other partners with media access needs, including Stanford University, University of Virginia, Harvard University, New York University, University of Connecticut, University of Miami, University of York (UK), WGBH/Boston, and the Rock and Roll Hall of Fame, have agreed to serve as advisors, testers, and potential development contributors for the project.

The VoV system is envisioned as providing a baseline level of online access to audio and video collections from across a diverse set of campus units. This system will be developed to work in conjunction with a Fedora-based digital repository environment. It will enable a variety of access control models necessary to support the diversity of needs within a large institution, ranging from open access on the web to access to an item in an archival collection granted on request to a single scholar for a limited period of time. To support the diversity of approaches to managing and providing access to media collections within an institution, the system will be able to import existing descriptive metadata, in formats such as MARC and EAD, as well as support direct entry of metadata in PBCore.

Partnerships have been established with several other related open-source efforts, including the Opencast Matterhorn project, focused on classroom lecture capture and access, and the Hydra Project, which is developing tools on top of the Fedora digital repository system, an integral part of the DLP's digital repository infrastructure.

It is envisioned that the Variations on Video system would serve as a baseline discovery, delivery, and access system for media collections digitized as part of the MPI, but additional development and extension or adoption of existing tools, such as the EVIA Annotator's Workbench, may be required to best meet online access needs for specific types of collections such as ethnographic materials, oral histories, and Western art music.

Task Force Recommendations

24. Appoint a task force that will develop specific recommendations for broad media access issues at IU Bloomington. These recommendations should address the access principles and issues related to stewardship, special collections policies, curatorial responsibilities, metadata management and discovery systems, and rights management.
25. Expose both tangible media holdings and digitized content to search engines and discovery environments as widely as possible.
26. Create derivatives of all preserved content that enable items to be delivered online, with systems and policies in place so that access can be controlled in accord with legal requirements and ethical standards.
27. Provide a basic but extensible infrastructure for media access that serves research, instruction, media production, and the administration of media assets.

8 Technology Infrastructure Analysis and Needs

Key Points

The value of digitizing campus media holdings will be realized only if systems for long-term preservation and access are in place.

Indiana University's existing infrastructure and expertise place it in a strong and unique position among research universities to be able to provide these capabilities.

The Media Preservation Initiative will generate a total of 39 PB of data over fifteen years, making it the largest single contributor to the Scholarly Data Archive (SDA). However, by year five, its proportion of SDA total storage will be only an estimated 9 percent.

Focused and timely development, utilizing additional personnel, of the Digital Library Program's preservation repository is necessary before the IMPAC begins to generate large amounts of preserved content.

Digitization of IU Bloomington's media collections will prove valuable only if technical mechanisms are in place for long-term storage and access. Indiana University's existing infrastructure and expertise in the areas of research storage, high-performance networking, digital libraries, and media streaming place it in a strong and unique position among research universities to be able to provide these capabilities.

Preservation

Preservation Repository

The Digital Library Program (DLP) has been working for the past ten years to develop a repository service for digital collections access and preservation, based on the open source Fedora Commons digital repository software platform. This service operates within the UITS Intelligent Infrastructure virtual storage and server environment to manage content and metadata for digital objects generated by libraries, archives, and academic units from across IU Bloomington and other IU campuses, including text, still image, audio, and video formats. Derivative files are typically managed within the Fedora repository and are stored on disk, while master files are stored within IU's Scholarly Data Archive (SDA) environment, with references to their location stored in Fedora. A companion piece of software, called Archiver, manages the process of staging new master files to the SDA, and validating the fixity of files stored in the SDA, both immediately after transfer and potentially at a later date.

Scholarly Data Archive

The Scholarly Data Archive, formerly known as the Massive Data Storage System (MDSS), is managed and supported with base funding by the Research Storage group in UITS Research Technologies. Using the consortium-developed High Performance Storage System (HPSS)

software, the SDA currently offers approximately 5.7 petabytes of tape- and disk-based storage distributed between the data centers at Indiana University Bloomington and Indiana University- Purdue University Indianapolis.

Physical storage

Current estimates for MPI indicate that the archival data requirement would total 39 petabytes (PB) over fifteen years. This starts with 1.4PB the first year and increases to a peak ingestion rate of 3.8PB in year ten. It trails off to 1PB per year by year fifteen.

The Research Storage team has a forecast model for IU's archival requirements and anticipated costs. This forecast is based on the past ten years of operation and careful study of the trends in digital archival storage. While this forecast extends out to ten years, which is the expected lifespan of the current automated tape libraries, forecasting nearly anything in IT beyond five years is little better than guesswork.

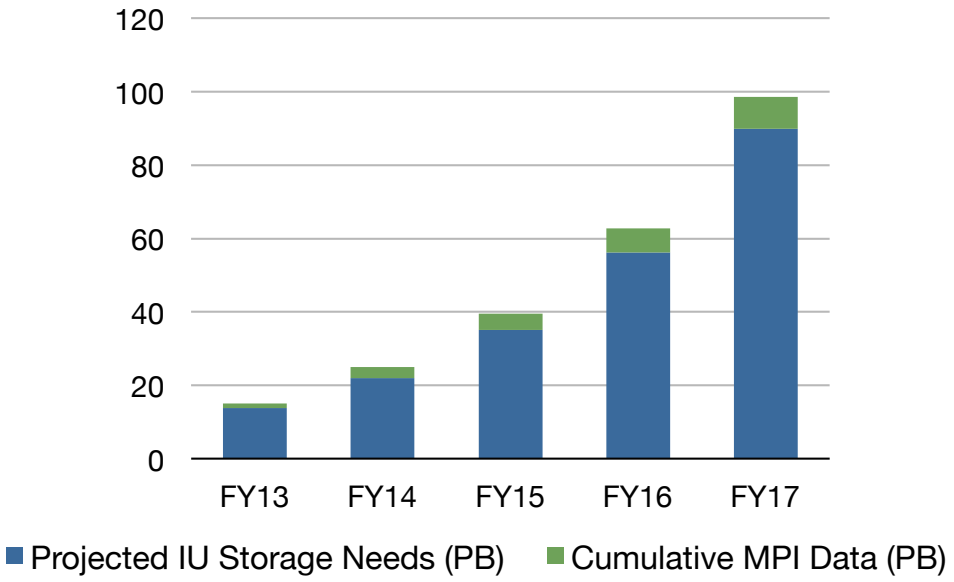
Over the past five years, IU's faculty, staff, and students have been storing archival data with an average growth rate of 66 percent per year. This is used to predict a baseline growth requirement for IU. Likewise, the previous five years worth of costs for everything including media, hardware, staff, software licensing, and such are used to create a cost model. Power and network infrastructure are the only things excluded from these costs.

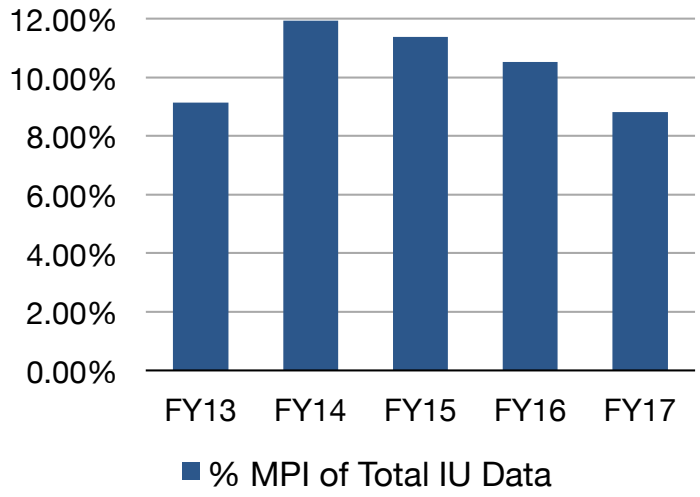
The Research Storage team used the MPI data analysis to determine the storage impacts on the SDA during the first five years of the MPI and assumed the MPI would start archiving data in fiscal year 2013, which begins July 1, 2013. This forecast assumes that two copies will be kept for all data and that the copies will be geographically separate between IU Bloomington and IUPUI data centers.

While individually the MPI would become the largest single contributor to the SDA, the impact of the MPI on the total amount of archival data is relatively small. This is illustrated in the first table depicting the expected baseline growth of IU archival data with the cumulative total of MPI data for the first five years.

As a percentage of the total IU data stored, MPI initially grows to 12 percent of the total, but by the end of year five the percentage drops below the initial 9 percent of total storage. It remains below that level for the rest of the MPI fifteen-year projection.

Figure 18: MPI Data and Projected IU Storage Needs





The Research Storage model includes a total cost of ownership (TCO) forecast as well as a media forecast. The TCO allows for the cost of tape in the library, tape drives to support access, disk cache infrastructure, system administration staff, etc. The media cost forecast assumes that every four years, the price per TB will be cut in half. Because these costs are specific to the institutional context at Indiana University Bloomington, we have not included them in this public version of the report.

Table 8: MPI Storage Needs

Year	Total Yearly TB	
	Yearly TB	Cumulative TB
1	1,380	1,380
2	1,593	2,973
3	1,530	4,503
4	2,097	6,600
5	2,086	8,686
6	2,911	11,597
7	2,965	14,562
8	2,909	17,472
9	2,877	20,349
10	3,862	24,211
11	3,860	28,071
12	3,621	31,692
13	3,299	34,991
14	3,007	37,998
15	601	38,599

Networking and data bandwidth

The consultants' data analysis indicates that the peak amount of data being stored in the archive is 14.9TB per day in year ten. Forecasting farther out than five years in IT is akin to reading tea leaves, so the peak rate expected is effectively ignored for the purposes of this analysis. However, it is safe to assume that data rate capabilities will be significantly higher ten years from now.

The peak rate in the first five years is expected to be about 8TB per day. Assuming this would be transferred in one eight-hour shift during the day, this yields a data rate of 284MB/sec. The current drive technology streams data at 250MB/sec. Two tape drives worth of capacity at eight hours per day is sufficient to accommodate the MPI. The SDA will have 48 production drives at that time.

The SDA is provisioned with an aggregate of 5GB/sec Ethernet capacity on the Bloomington campus research network. Currently the standard campus network only has 2.5GB/sec capacity between it and the research network. So even if the IMPAC facility is attached to the standard campus network, it would require no more than 11 percent of the bandwidth for eight hours per day.

Even if additional storage resources are needed for items such as the backup of interim storage, SDA will have enough capacity to support MPI.

Enabling Preservation

While the combination of SDA, Fedora, and Archiver provides an excellent basis for preservation storage and management, work is still needed to transform this combined platform into a trustworthy digital repository. Preservation metadata requirements need to be defined, and tools need to be developed to support audio and video preservation package validation, technical metadata capture, and repository ingest.

The DLP recently began a self-audit of IU's repository environment using the Trustworthy Repositories Audit and Certification (TRAC) checklist published by the Center for Research Libraries. This checklist establishes certain functional, technical, and policy requirements for a repository to be considered trustworthy. Based on initial results, many of the TRAC requirements are satisfied, but additional policies and tools must be developed to support some requirements, and certain operational aspects of Fedora, Archiver, and SDA need to be better documented to increase transparency of procedures. Strategies and tools need to be developed to ensure ongoing verification of content stored in the repository.

Additional staff are required in both the DLP and UITS Research Storage to focus on development of these new policies and tools for digital preservation. The Task Force recommends the following positions for systems analysis and development:

1. **Programmer/Analyst, Workflow Tools (DLP)**
   This position will work to design, build, implement, and support tools to meet the workflow, process tracking, and administrative/technical metadata creation requirements of the MPI, building on previous tools developed by DLP as part of the Sound Directions project.

2. **Programmer/Analyst, Digital Preservation (DLP)**
   This position will design, develop, and implement data models and tools to support the ingestion of audio and video media into IU's emerging preservation repository and tools to carry out ongoing validation of data integrity and future migration of content to new file formats. This position will work closely with other DLP staff involved in developing and managing IU's Fedora repository and with staff in the UITS Research Storage group who manage the SDA.

3. **Programmer/Analyst, Archival Storage (UITS Research Storage)**
   This position will design, develop, implement, and support tools within the SDA to support validation of data integrity and other functions necessary for integration of SDA with Fedora for use as a preservation storage system. This position will work closely with the Programmer/Analyst, Digital Preservation in DLP.

Interim Storage

To support the first five years of IMPAC operations, 200TB of interim working disk-based storage is required, along with the ability to support approximately 8TB/day of data staging from production workstations to interim storage from the SAN to SDA by year 4. This combination of storage volume and rate of production imposes unique requirements for capacity, performance, and availability. The option currently proposed to support MPI's interim storage needs is the acquisition of a specialized high-performance high-density Network Attached Storage (NAS) device. This NAS device would be located either in a

machine room within the IMPAC facility or at the IUB Data Center, depending on networking, power, and air conditioning requirements. Read/write access to the interim storage file system would be provided to Windows and Mac production workstations via CIFS (Common Internet File System) and to processing servers via NFS (Network File System).

Interim storage technology will likely need to be refreshed every five years due to hardware obsolescence and changes in technology. Thus, while a peak of 370TB of interim storage is required to support year ten of operations, it does not make sense to examine costs for that level of storage at this time.

Additional discussions should take place with UITS to explore the possibility of using the UITS Intelligent Infrastructure SAN environment or other UITS-managed storage environments, but care must be taken to ensure that these options would support the data volumes and rates required.

Network Connectivity

To support the expected production volume of IMPAC during the first five years, 10 Gigabit/second Ethernet (10GbE) connectivity will be required between the NAS and production workstations, transcoding/processing servers, and the SDA. This will necessitate 10GbE connectivity between the building in which the IMPAC production facility is located and the research network in the IU Bloomington Data Center, on which the SDA is located, as well as 10GbE connectivity within the IMPAC facility. Once a facility location has been identified, further discussions with UITS will be required to determine optimal network design and costs.

Access

Media Transcoding

Efficient transcoding of audio and video master files into high-quality derivatives appropriate for online access and other uses is an important capability that will need to be developed to support the MPI. A number of options are possible for providing this capability, including both commercial and open source tools, and further evaluation is required over the next year to develop a final strategy for transcoding. Specific options to be evaluated are the commercial Rhozet Carbon Coder, currently in use at Radio/TV and within the UITS Video Infrastructure group; the open source FFmpeg transcoder, currently in use within the Video Streaming Service operated by DLP; and the configurable media processing workflow component of the Opencast Matterhorn system, which also utilizes FFmpeg.

Beyond software, appropriate computational resources will need to be deployed to support the IMPAC's expected workflow and production rates. Based on benchmarking with FFmpeg, a dedicated server is currently proposed for transcoding and other media processing operations.

Media Streaming

IU has a robust online media delivery infrastructure, managed by the Video Infrastructure group in UITS Enterprise Systems. This infrastructure combines NAS-based storage with a suite of media servers, currently including Adobe Flash Media Server, Microsoft Windows

Media Services, and the Wowza Media Server. The MPI plans to leverage this existing infrastructure, and support its expansion if needed, to provide media streaming and delivery for online access to a variety of client platforms. Additional work will be undertaken over the next year to determine more exact storage and bandwidth requirements to ensure that this system will be capable of accommodating the volume of content and potential use. Content Distribution Network needs and options will also be explored, particularly for support of research use of content beyond North America.

Cataloging

As part of the Variations on Video system discussed in Chapter 7, the Digital Library Program intends to develop tools to import metadata from existing formats in common use in libraries and archives, notably MARC and EAD (Encoded Archival Description), and map these formats to the PBCore standard for audio and video metadata to enable identification and discovery within an online delivery system. This system, if development is funded, will also include a web-based interface for entry and editing of PBCore-based metadata for items held in collections not currently cataloged and will also support the import of CSV (comma-separated value) data exported from databases and spreadsheets.

Research Software Tools

Beyond basic online access (discussed in Chapter 7, above), some researchers will require more advanced tools for working with time-based media, including capabilities for annotation, transcript creation and alignment, content analysis, and customized presentation. Access systems for MPI should be implemented in a way that allows integration with research tools through standard formats, APIs, and web services and with emerging digital content cyberinfrastructure environments such as that being developed by Project Bamboo.

Collection and Object Management

While some of the units whose collections would be processed by the MPI have robust systems and methods in place for tracking the acquisition, accession, inventory, and disposition of their physical collections and media items, many (especially non-library units) do not. The MPI should undertake further assessment of unit needs in this area and make recommendations for the implementation or use of collections management systems for management of audiovisual collections, including archival collections management systems (e.g. Archon, ArchiveSpace, Mavis), museum collections management systems (e.g. CollectiveAccess, CollectionSpace), and emerging library management systems (e.g. Kuali OLE).

Development Needs and Timeline

Role of UITS Research Technologies

The Research Storage group in the UITS Research Technologies division manages the Scholarly Data Archive, which will be used as the archival storage system for the MPI. Given appropriate funding and the addition of a programmer/analyst position (see above), Research Storage staff will be responsible for implementing expansion of the SDA environment to accommodate the data storage requirements of MPI and for implementing and managing

services to work in conjunction with DLP systems to carry out validation of data integrity for MPI materials stored in SDA.

Role of DLP/Libraries

The Digital Library Program, with the addition of staff discussed above, will be responsible for the development of workflow and metadata tools required for MPI and for the development of processes and tools for ingestion of audio and video content into IU's preservation repository system. In addition, DLP will be responsible for managing the preservation repository, in conjunction with UITS Research Storage.

Library Technologies Core Services, with the addition of staff discussed in Chapter 6, will be responsible for providing ongoing IT support for the IMPAC facility.

Timeline

Preservation repository development must be carefully timed with the start of IMPAC operations. That is, specific functionality must be in place before the IMPAC generates too large of a backlog of digital files that must be processed and preserved. Once the IMPAC is operating at full speed, it may be difficult to play catch up. The Task Force recommends completing the development of basic ingest functionality for audio, video, and film content within six months of the start of IMPAC operations. This objective requires beginning the programmer/analyst for digital preservation position at least six months prior to the start of IMPAC operations. Likewise, the IMPAC requires workflow tools to make its operations both feasible and efficient. The Task Force recommends completing the development of basic IMPAC workflow tools within three months of the start of IMPAC operations. This objective requires beginning the programmer/analyst for workflow tools at least six months prior to the start of operations.

Task Force Recommendations

28. Prioritize preservation repository development so that ingest of audio, video, and film content may begin within six months of the start of IMPAC operations. Basic IMPAC workflow tools should be in place within three months.
29. Develop repository preservation services including ongoing data integrity checking.
30. Hire three programmer/analyst positions for preservation repository development and support.
31. Evaluate options for media transcoding and adopt specific recommendations.
32. Working with UITS, determine optimal IMPAC network design and costs once a facility location has been identified.
33. Determine storage and bandwidth requirements for media streaming and evaluate how MPI needs fit with existing campus resources.
34. Assess IU Bloomington unit needs for collection and object management tools.

9 Campus Engagement

Media Preservation Initiative (MPI) work broadly engages Indiana University Bloomington's research, teaching, and service missions. MPI Task Force recommendations build upon existing campus resources and strengths to implement solutions to the media preservation and access crisis. It is with these existing strengths—the IU Libraries (including the Digital Library Program), University Information Technology Services (UITS), special collections units, the IU Cinema, the School of Library and Information Science (SLIS), and others—that we find the deepest engagement. The products of MPI work—preserved and accessible media collections—will transform research and instruction for faculty and students whose work can benefit from media resources. Direction on how to use these resources can be provided at the proposed Research Commons in Wells Library. These points of engagement, explored below, demonstrate the ways in which MPI work will contribute to, and integrate with, campus priorities and needs.

The Research Commons in the Wells Library was proposed soon after the demonstrated success of the Information Commons on the first floor of the West Tower. The transformation of the Information Commons from a vast reference area into spaces for instruction and for individual and collaborative work has dramatically altered its use by undergraduate students. The Research Commons has been conceived as a companion to the Information Commons, with an emphasis on serving the needs of researchers.

The Research Commons will provide a dynamic community space for faculty and graduate students to collaborate on and find support for new and emerging forms of scholarship, teaching, and research. By assembling groups and expertise now distributed throughout the IU Bloomington campus, the Research Commons will blend technology with traditional resources to serve as a center for a wide range of research and teaching activities. It is envisioned as a space to educate scholars about available tools and funding opportunities, and help them find and utilize resources. The Research Commons arises out of a growing need for assistance in areas such as advanced visualization and imaging, statistical analysis, data mining, collection management, and media preservation and access. Areas that interface with publishing such as intellectual property and IU Scholarworks are also key elements of the proposed development.

The Indiana Media Preservation and Access Center (IMPAC), along with the Digital Library Program and campus media-holding units, will preserve and make available tens of thousands of hours of time-based media. These research materials will be a boon to faculty and student researchers and instructors alike. The Research Commons can serve to guide scholars to these resources while functioning as a community within which new tools for curation, analysis, and instruction may be built. The Research Commons can also provide an interface and service point for scholars who have or are currently building collections of research media. Both older analog and more recent digital media must be actively managed, and the Research Commons staff can provide consulting about how to best preserve and provide access to these types of collections.

At the present time, the Media Preservation Initiative is linked to the Institute for Digital Arts and Humanities (IDAH). Both are focused on research. IDAH works with faculty in the beginning of the research life cycle, starting when faculty conceptualize projects, develop prototypes, and apply for grants. IDAH also assists faculty in getting software developers who

can work on faculty projects. MPI is critical to the preservation of, and access to, data once the project has been carried out. In this case, MPI is most active in the middle and end stages of research for faculty. Of course, it is critical that faculty have a clear understanding of the full life cycle of data as they start projects and what the implications of their work will be for the end stages of preservation and access. IDAH and MPI will be working closely with faculty to invigorate the various stages of research and creative activity. Since IDAH and MPI have space in the first floor of the East Tower of the Wells Library, they have already begun to be part of the Research Commons. Faculty can drop in to talk with staff about ideas that are still nascent and begin to get advice on a range of areas.

In the future, libraries will distinguish themselves through their unique special collections, particularly as books are increasingly made available online. IU Bloomington holds a wealth of unique collections.

The Digital Library Program, a joint operation of the IU Bloomington Libraries and UITS, is a pivotal partner in both the development and ongoing work of the IMPAC. Programming positions supporting the center's work will be located at the DLP, and these positions will initially develop workflow software and key pieces of infrastructure. Rapid, successful development in these areas is essential for reaching campus preservation targets. An operational preservation repository is necessary before the IMPAC begins work at full capacity and hundreds of thousands of digital files accumulate. The DLP has made considerable progress in developing a preservation repository but it is not yet capable of ingesting audio, video, and film content. Plans for completing this development are outlined in the technology chapter of this report. Once objects are digitally preserved, the DLP will play a major role in developing and managing a baseline campus access infrastructure. The DLP's role in this development will help ensure that media access is well integrated into other online environments used on campus by students and faculty. In particular, integration of media access into the Oncourse collaboration and learning environment is essential to effective teaching and learning use of collections. Digital Library Program work is critical to the success of both daily IMPAC operations and the achievement of long-term campus preservation and access goals.

The IU Cinema is already an important outlet for the screening of archival films. Digitized content from the IMPAC will make available to the Cinema an even wider range of film-born content. While a general preference exists for projecting the film itself, the digital capabilities of the IU Cinema can support the screening of archival films. High-quality digital scans can be shown with minimal setup and may be particularly appropriate for small research or instructional groups. If a film is damaged, showing a digital version will save wear and tear on that print, preventing further degradation.

The Task Force envisions the IMPAC as closely connected to the IU Libraries. In the future, libraries will distinguish themselves through their unique special collections, particularly as books are increasingly made available online. IU Bloomington holds a wealth of unique collections, many of them carried on media formats, and making these readily available will further increase the IU Libraries' stature. The Lilly Library holds seminal film collections from a number of directors and collectors; Music Library recordings document the

internationally acclaimed Jacobs School of Music; the Archives of Traditional Music provides ethnographic collections dating from the 1890s that are used by researchers worldwide; and the Archives of African American Music and Culture features materials from internationally prominent artists. These IU special collections units and others are searching for media preservation and access solutions. The work of the IMPAC, the DLP, and other campus collaborators will result in an enduring preservation and sustainable access path for the media holdings of these units. This path would otherwise not exist. As units embrace responsibilities in specific areas such as prioritization and organization, the IMPAC will provide assistance. Sustained collaboration is necessary to realize successful long-term preservation and access of media holdings. In this way, special collections units are highly entwined in MPI objectives, the work of the IMPAC, and the future of the IU Libraries.

The IMPAC will necessarily rely upon the support of other units as well. Given its data-intensive objectives, the IMPAC must be integrally supported by UITS. Long-term media preservation relies upon the types of data services provided by this unit. During its initial development, however, we recommend establishing the IMPAC as a center under the Office of the Vice Provost for Research (OVPR) which supports centers, institutes, and museums on the Bloomington campus that provide special environments for research and other scholarly activities. With its experience facilitating the development of collaborative, multidisciplinary research centers, OVPR can provide the logistical and structural support needed to develop the IMPAC quickly.

It is also evident to the Task Force that media preservation and access work intersect with multiple present and future research and instructional agendas of IU Bloomington faculty, staff, and students. Faculty and students will have access to the vast and renowned audio, video, and film holdings owned by IU Bloomington. In a media-saturated world where access to media is increasingly a research imperative and an instructional benefit, this will be a significant advantage. Students in a number of schools and departments such as School of Library and Information Science and the Jacobs School of Music's Recording Arts can be educated and trained by the IMPAC. Developing a media preservation track within SLIS would enable students to specialize in this area. In short, MPI work offers rich engagement with campus research and instructional priorities.

The Task Force does not expect this engagement to stop, nor will the work of the IMPAC suddenly end, after the fifteen-year time period for preservation recommended in this report. Increasingly, new media acquisitions will be digital file-based and will require active preservation and access workflows to survive. The IMPAC will provide services in this area as well as evolve in response to changing media preservation and access landscapes in ways that cannot be predicted. Plus, putting the IMPAC into operation will act as a magnet, attracting desirable new collections in older formats. The Task Force also envisions opportunities outside of Bloomington on

Faculty and students will have access to the vast and renowned audio, video, and film holdings owned by IU Bloomington. In a media-saturated world where access to media is increasingly a research imperative and an instructional benefit, this will be a significant advantage.

other IU campuses or from CIC institutions, for example. We also expect demand for media preservation services from other continents beyond the next fifteen years. Given Indiana University's strong international ties, this could result in additional fruitful partnerships.

Pursuing future opportunities that involve digitization will bring us face-to-face with the threats of obsolescence and degradation. To continue digitizing legacy recordings past fifteen years, we must develop and sustain media preservation expertise and stockpile equipment now to combat obsolescence. Even so, a number of recordings will be unplayable or playable only with diminished fidelity due to degradation. By acting now to gather expertise and equipment, IU Bloomington may be able to extend for some media items the fifteen- to twenty-year window of opportunity defined earlier in this report.

The work of the IMPAC will require collaboration across several university sectors to be successful. Collaboration is necessary to fully realize the impact the center can have on research and instruction at IU Bloomington. These partnerships will enable the center to engage users more directly and ensure that the work of preservation is realized through robust access. The resulting media content will serve as primary sources for research, instruction, publication, and service for generations to come.

10 Next Steps

Media Preservation Initiative 2011-12 Objectives

During its first year of work, the Media Preservation Initiative Task Force focused on developing solutions to the challenges posed by legacy media. This included analog objects as well as physical digital formats such as Digital Audio Tape, CD, and MiniDV. In year two, we will turn our attention to the other side of the born digital dilemma, developing management strategies and workflows for file-based born digital recordings. The Task Force has identified a number of other research topics and objectives for its second year of work:

- Explore partnerships with other CIC institutions.
- Develop a prioritization plan with units.
- Manage the IMPAC startup plan including workflow development and testing.
- Work with architects on facility design and development.
- Explore media preservation and access needs on other IU campuses.
- Design quality assurance and quality control plans for the IMPAC.
- Evaluate options for efficient transcoding to create derivatives.
- Evaluate storage and bandwidth requirements for media streaming.
- Develop procedures for filling unit researcher orders.
- Explore collection and object management systems.
- Undertake a second video preservation pilot project with Radio and Television Services.
- Undertake a film access digitization pilot project with vendors.
- Survey local unit discovery and management systems.
- Form a media access policy task force.
- Explore content capture from the Big 10 Network.
- Explore faculty media collections.

Indiana Media Preservation and Access Center Start-up Plan

The Task Force recognizes that funding must be secured for the IMPAC and construction plans developed and approved. However, the Task Force feels it is also imperative to capitalize on current momentum and seize an emerging opportunity to begin preservation work. We note that the digitization portion of IU's NEH-funded Sound Directions project ends June 30, 2011, leaving experienced audio preservation personnel available. This prompts us to explore ways to leverage additional existing resources on the Bloomington campus to begin IMPAC work. The result is the development of a start-up plan in collaboration with the Music Library, Radio and Television Services, the Libraries, and the Archives of Traditional Music, funded by the second year allocation for the Media Preservation Initiative. It does not require funds that have not already been requested.

This plan will operate fiscal year 2011-12 and enables the Task Force to

- begin preserving IU Bloomington audio and video collections slowly but steadily; expand conservation work on film;
- test proposed workflows, demonstrate proof of concept, and gain experience;
- create a small body of extremely high value preserved content for use with stakeholders and potential donors;
- utilize existing campus resources to their highest capacity in service of campus media preservation goals;
- use administrative staff to ramp up planning for construction and operation of the IMPAC;
- coordinate working groups that will establish further recommendations and policies relating to preservation and access.

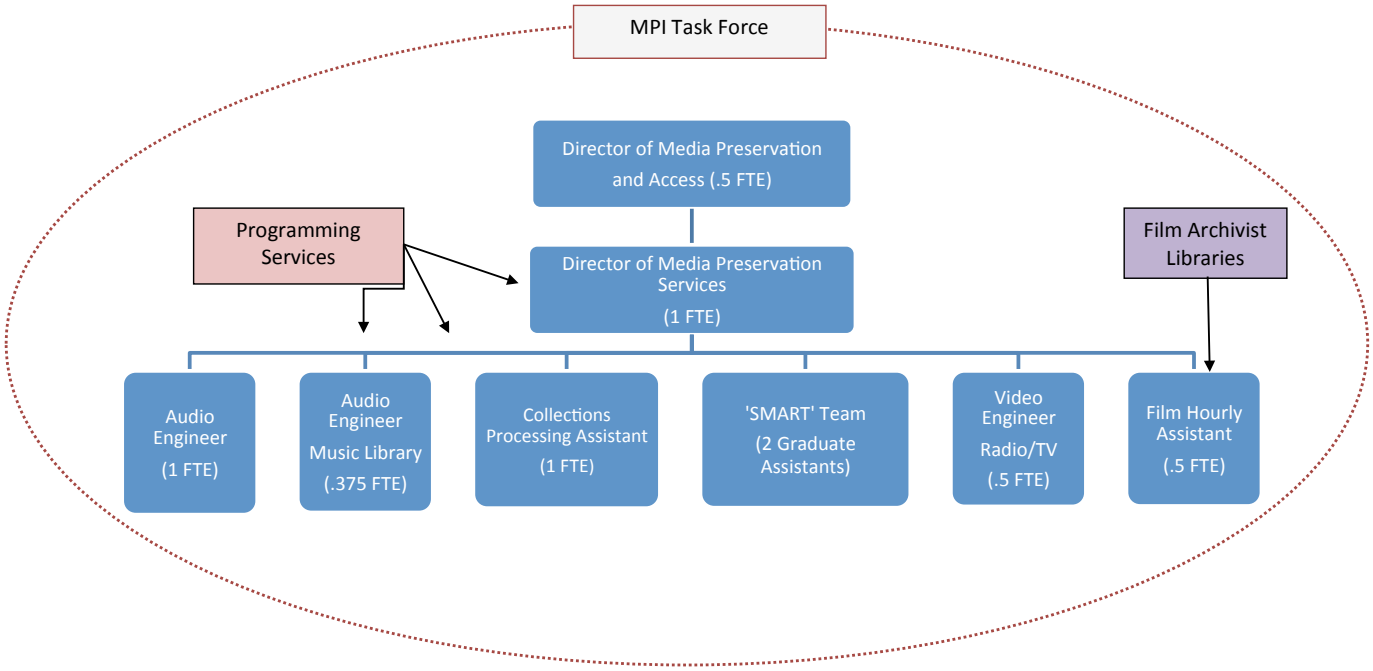
This plan leverages the following existing resources:

- Archives of Traditional Music preservation studios and equipment
- Music Library preservation studio and equipment
- Radio and Television Services studios and equipment
- Experienced audio engineer and processing assistant from the *Sound Directions* project
- WTIU engineers experienced with legacy video formats at .5 FTE (with salary replacement provided by MPI)
- Music Library audio engineer at .375 FTE to work on Music Library content using IMPAC workflows and guidelines (funding for a supporting hourly worker provided by MPI)
- MPI project graduate assistants with media preservation experience for SMART
- Sound Directions project metadata software and digitization workflow research
- Sound Directions project workflow for audio preservation
- The Libraries' Film Archivist for whom the MPI will find an hourly assistant

Under this start-up plan, IU Bloomington will preserve an important but relatively small portion of its holdings. We must build the IMPAC to make real progress. Nevertheless, this project will enable the campus to test workflows and gain experience in areas critical to the future operation of the IMPAC.

Below is a diagram that outlines the personnel for the start-up plan.

Figure 19: Staff for IMPAC Startup Plan



Task Force Recommendations

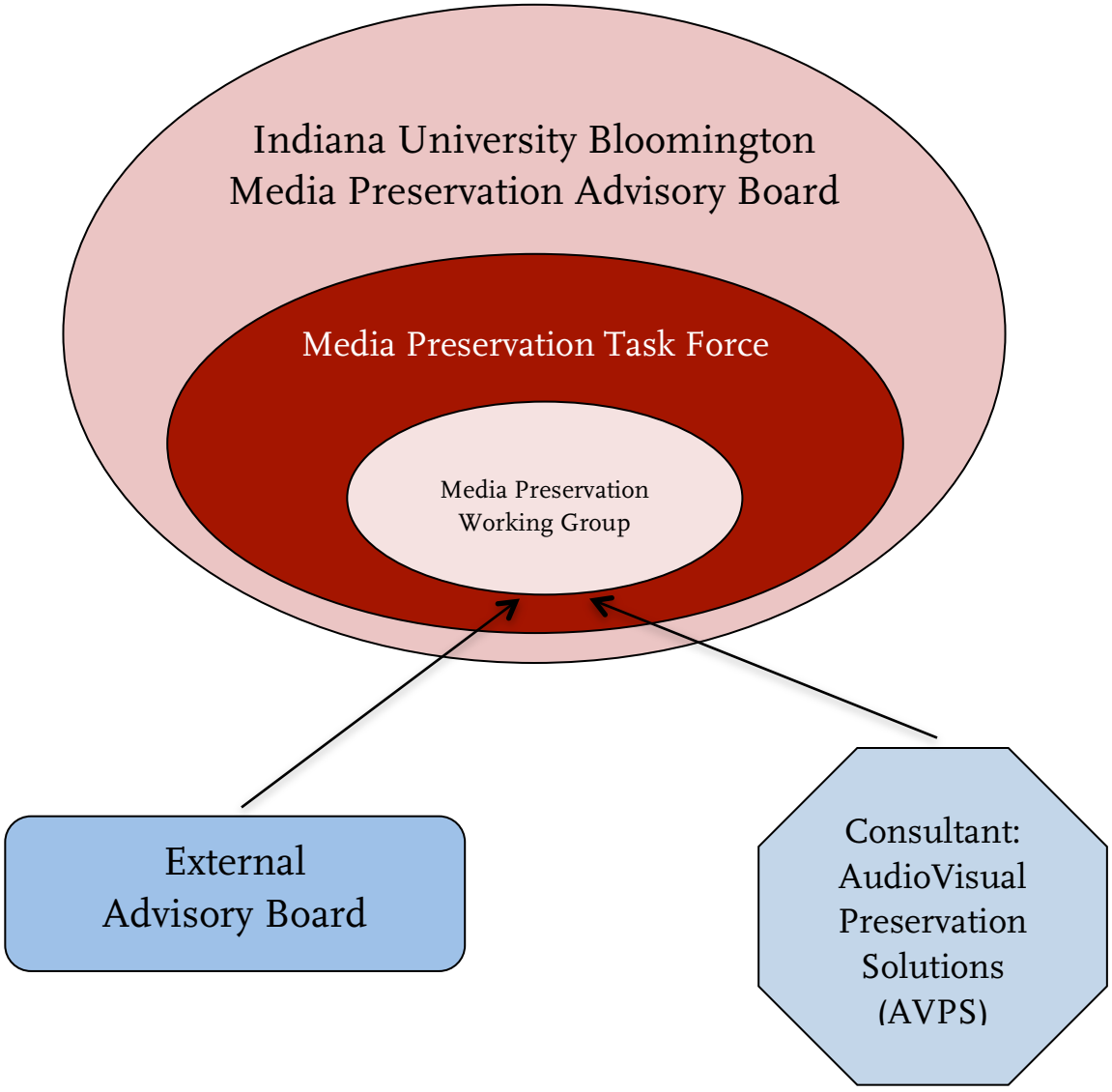
35. Enact the IMPAC start-up plan immediately to test workflows, gain preservation experience, utilize existing campus experience and resources, and engage in other activities in preparation for future IMPAC operation.

Appendix 1: Project Structure and Personnel

Project Personnel

A subset of the Task Force named the Media Preservation Working Group was formed at the beginning of the project as a more nimble research team. The Working Group meets weekly, is responsible for the day-to-day research that serves project objectives, and reports to the larger Task Force. Two advisory boards provide counsel to the Task Force. A Bloomington board is made up of key campus stakeholders and has met twice to date in October 2010 and March 2011. An external advisory board, which consists of national and international media preservation experts, was convened at the joint International Association of Sound and Audiovisual Archives/Association of Moving Image Archives conference in November 2010. All project personnel are listed below.

Figure 20: Media Preservation Initiative Groups and Relationships



Task Force Members

Role: Responsible body—development, direction, decisions, occasional research tasks

- **Ruth Stone**, Task Force Director—Associate Vice Provost for Research, Office of the Vice Provost for Research; Professor, Department of Folklore and Ethnomusicology
- **Alan Burdette**—Director, Archives of Traditional Music; Director, The EVIA Digital Archive Project
- **Mike Casey**—Associate Director for Recording Services, Archives of Traditional Music; Managing Director, Sound Directions Project
- **Mechael Charbonneau**—Associate Dean for Technical Services, IU Libraries
- **Jon Dunn**—Director, Library Technologies and Digital Libraries, IU Libraries
- **Mark Hood**—Assistant Professor, Department of Recording Arts, Jacobs School of Music; Chief Engineer, Sound Directions Project
- **Suzanne Lodato**—Co-Director, Institute for Digital Arts and Humanities; Assistant Scholar for Research Development, Office of the Vice Provost for Research
- **Rachael Stoeltje**—Film Archivist, IU Libraries
- **Carolyn Walters**—Executive Associate Dean, IU Libraries
- **Eric Wernert**—Senior Manager, Visualization, Research Technologies, University Information Technologies Services

Working Group Members

Role: Conduct weekly research, prepare draft documents, and assemble background information for Task Force

- **Ruth Stone**
- **Alan Burdette**
- **Mike Casey**
- **Jon Dunn**
- **Mark Hood**
- **Rachael Stoeltje**

Indiana University Bloomington Advisory Board

Role: High-level guidance from campus stakeholders, convened twice during planning year

- **Phil Ponella**—Director, Cook Music Library
- **Phil Bantin**—Director, Office of University Archives and Records Management
- **Cherry Williams**—Curator of Manuscripts, Lilly Library
- **Brenda Nelson-Strauss**—Head of Collections/Technical Services, Archives of African American Music and Culture; lead author for the national audio preservation plan, National Recording Preservation Board, Library of Congress
- **Konrad Strauss**—Chair, Professor of Music, Department of Recording Arts, Jacobs School of Music
- **Perry Metz**—Executive Director, Radio and Television Services
- **Robert McDonald**—Associate Dean for Library Technologies, Libraries
- **Jon Vickers**—Director, IU Cinema
- **David Francis**—Former Chief, Motion Picture, Broadcasting and Recorded Sound Division, Library of Congress
- **Gregory Waller**—Chair, Department of Communication and Culture
- **Jeremy Gray**—Director of Broadcast Services, Athletics Department
- **George Vlahakis**—Media Manager/Media Specialist, IU News Room
- **Kurt Seiffert**—Manager, Research Storage, University Information Technologies Services

External Advisory Board

Role: High-level advice from media preservation experts, convened once during IASA/AMIA conference with some follow-up

- **Howard Besser**—Director, Moving Image Archiving and Preservation Program, Cinema Studies Department, New York University
- **Kevin Bradley**—Curator, Oral History and Folklore; Director, Sound Preservation, National Library of Australia; President, International Association of Sound and AudioVisual Archives
- **Carl Fleischhauer**—Office of Strategic Initiatives, Library of Congress
- **Martin Jacobson**—Director, Special Media Preservation Division, National Archives and Records Administration
- **Kate Murray**— Digitization Process Development Specialist, Special Media Preservation Division, National Archives and Records Administration
- **Dietrich Schüller**—Director Emeritus, Vienna Phonogrammarchiv
- **Greg Lukow**—Chief, Motion Picture, Broadcasting and Recorded Sound Division, Library of Congress
- **Isaiah Beard**—Digital Data Curator, Alexander Library, Rutgers University
- **Ken Weissman**—Supervisor, Film Preservation Laboratory, Library of Congress
- **Rick Prelinger**—Independent Film Consultant
- **Andrea Leigh**—Head, Moving Image Processing, Library of Congress
- **Snowden Becker**—Independent Film Consultant
- **Katie Trainor**—Film Collections Manager, Department of Film, Museum of Modern Art

Project Research Assistants

- **Eric Bindler**
- **Patrick Feaster**

Project Consultant

AudioVisual Preservation Services (AVPS) http://www.avpreserve.com/avpsresources/

AVPS staff working with the Task Force:

- **Chris Lacinak,** President
- **David Rice**, Senior Consultant

AVPS is a consulting firm that provides resources to help institutions preserve, access, and distribute their audiovisual assets. They have completed major projects for a number of clients including Stanford University, Yale University, New York University, Library of Congress, National Archives and Records Administration, Department of Defense, United Nations, Corporation for Public Broadcasting, and many others. The Task Force has used AVPS to provide expert assistance in many areas, but particularly to develop data used to construct the build plan including the creation of detailed preservation workflows. These workflows include data on the time required to complete each step in the preservation transfer process for each format, using metrics developed by AVPS from their work with a number of institutional clients, including data from time-motion studies.

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