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AUDIO MEDIA PRESERVATION THROUGH IMAGING CONFERENCE

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FRIDAY
JULY 17, 2015

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The Conference met in the West Dining Room, Library of Congress, 101 Independence Avenue, S.E., Washington, D.C., at 9:30 a.m.

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TABLE OF CONTENTS

P-R-O-C-E-E-D-I-N-G-S

(9:31 a.m.)

MR. ALYEA: Good morning. I guess this is everyone. So, this is the second day. We are going to start off with a talk by James Nye.

MR. NYE: Well, I'm James Nye. I'm at the University of Chicago. I'm really pleased to be with you and to have this opportunity to reflect on what it means to recover the heritage of recorded sound from a world region. And in this case, I am particularly talking about South Asia.

In contrast to most of yesterday's presentations, I will be looking at the uses of recovered and preserved sonic recordings. So, my reflections today are organized not in a PowerPoint but along five different themes. Let me review those for you quickly, so you will have a roadmap.

I am going to introduce myself, not for egotistical reasons but I would like to use it as a basis for describing some of the beliefs that have underpinned my work as a bibliographer because I am the bibliographer for Southern Asia at the

University of Chicago. And next, I will move on to describe a few key collaborating partners we have worked with. Using those collaborative partners' descriptions as a base, then I will move on to talk about a few of our current and near term projects. These will be just very quick sketches.

And then I will, as a fourth topic, I will reflect on some of the major impediments we have encountered so far as we have tried to engage in these preservation and access projects related to audio in South Asia.

And then finally, following Carl's good lead from yesterday, I will try to take a look at some of our needs and especially focusing on the needs that are of the highest priority.

So, as I said, I am the bibliographer for Southern Asia. I am not a scientist, nor am I an engineer. And what I am is a humanist. And I am responsible for building our collections as a humanist to serve the needs of faculty and students and the University of Chicago who work in the area of South Asia.

Now what is South Asia? Just to clarify it because there is sometimes confusion, I am talking about the nation states, that is the current nation states, including Afghanistan, Bangladesh, Bhutan, Burma, India, the Maldives, Nepal, Pakistan, Sri Lanka, and the Tibetan Regina of China.

You might say that this is that whole area that through tectonic shifts if pushed up and caused the formation of the Himalayan Mountains over time. But it is important to keep in mind that this accounts for something like 25 percent of the world's population.

Well, as I promised, there are two beliefs that I would like to announce here for you, things that have underpinned my work as a South Asia bibliographer. It was wonderful to hear that similar convictions were enunciated by Carl yesterday and by others.

Number one, it is my firm belief and it has been my practice to allow scholarship to be informed by open access to resources. Carl, you hit

on this very nicely, I thought, yesterday, as an important prerequisite for the kind of ways you have approached the IRENE system and its development.

So, why open access? For practical reason -- well, there are several but let me just say simply I found that having a level playing field between scholars who are in South Asia as compared to scholars who are in resource-rich institutions in the United States really presupposes that we are going to have open access. Otherwise, there is a disenfranchise, for our colleagues elsewhere in the world.

And number two belief is that the tools for discovering resources that we are developing, putting out for open access, those tools for discovery also need to be open and freely available.

Now, I hope you will see, as I move on, why these two beliefs intersect with some of the projects we have undertaken, will be undertaking, and how it interlinks with the overall contours of what I will be saying in these reflections today.

Moving on to brief descriptions then of

some of our collaborating partners. You may wonder why I am starting with collaborating partners instead of projects. Well, it has been, again, something I have discovered over the course of the last third of a century doing what I have been doing is that close links with people and with institutions usually have been the most important bedrock for accomplishing whatever it is we have been able to accomplish and, I believe, for whatever we may be able to accomplish over the coming years.

So, let me start describing collaborating partners at home, since you might say that most important collaborations really do have their roots at home.

As I say, I am at the University of Chicago and there I have been very fortunate to work with a gifted group of intellectuals. These include ethnomusicologists, anthropologists, linguists, people in computing, and more recently and not as firmly linked, I would say colleagues who are in the two national laboratories that are associated with the University of Chicago,

specifically Argonne and Fermi.

Moving out a little bit more broadly into the United States, considering the range of people we have been involved in, again, keeping in mind audio projects, I am very happy to say that Carl, our work together has been so important, formative, in more ways than I think you may realize, and the work as well with Earl.

Our linkages with you, things that will be discussed by my colleagues following in subsequent presentations this morning have been just invaluable.

Additionally, and not just because we are meeting at the Library of Congress, I have to say that the Library of Congress has been an absolutely critical player, a collaborator. And here, I am not thinking so much of this building, the Jefferson, the Adams, but I am thinking more particularly for our purposes in South Asia studies of the two field offices the Library of Congress maintains. Those are in Islamabad and in New Delhi.

And to give you just one brief example

of the depth and the value of those interrelationships, it was through the Library of Congress and maybe only because of the Library of Congress that starting in 1990 we were able to undertake an enormous preservation project dealing with books. These were books that were identified by use of a particular publication called the *National Bibliography of Indian Literature*, books published 1901 to 1953. We are still working on it but we have made tremendous success and I am happy to say that we have now preserved through microfilming, more recently digitization, some 37,000 volumes that, otherwise, were inaccessible in the United States. It is only possible because of our collaboration with the Library of Congress.

So without setting up any false expectations, I am really hopeful that this collaboration from Washington, as well as the field offices, may continue forward. Thinking of what we have already done in a minor way, Peter, but extending that perhaps into projects that are upcoming.

If I move out to Europe and think of collaborating partners there, not that I will engage or identify all of them, but I would like to single out EMI. And the EMI archive was mentioned a couple of times yesterday in presentations.

I'm happy to say that we have worked very closely with colleagues there at the archive but also at EMI Central on Abbey Road and have formal agreements, written agreements with the EMI folks that anything that is in their collections from South Asia, and that includes the documentary material -- we'll come back to that in a moment, as well as any of the audio recordings they have in their collections from South Asia up through 1942 can be digitized and made available for the world's use. They are not claiming any intellectual property and, in fact, they are quite pleased that those resources can be put in public view for the sake of scholarship.

Second, moving to Germany, we have had strong and continually increasing relationships with the Berlin Phonogram Archive. Carl, you

mentioned the Berlin Phonogram Archive yesterday briefly with the galvanos. It is Lars-Christian Koch, who happens to be a South Asianist, an ethnomusicologist, with whom we have been working and with whom we are hoping to expand our interconnection in the near-term.

And then finally in Europe, I would like to mention a key role that the British Library has played. We have worked with them in digitization for public presentation of some very early audio. In our first iteration, we have worked specifically with the sound recordings made by George Grierson, in association with the linguistic survey of India. There are 242 extraordinarily rare gramophone recordings. Only five copies of each of these recordings were ever produced. And those are now available for the public to access.

Extraordinarily powerful to hear the voices of people who were speaking in various dialects and in languages from the turn of the century, the 20th century.

And most importantly, if I move out

further to South Asia, this is really where the mother lode is of resources, ones that we need to address collaboratively. But let me just say that the Roja Muthiah Research Library and a few other institutions that are of extraordinarily stable quality and that have a gifted group of dedicated academics and also librarians and archivists have been absolutely key. And you hear more from my colleagues Sundar and Suresh a little bit later this morning.

Next, we have worked with an interesting group of private collectors. I guess I would call them almost maniacs, although it may be a needless duplication to say that a private collector is a maniac because they go together invariably, it seems.

In this particular instance, South Asia, our closest collaborations have been with the Society of Indian Record Collectors. It is a far-flung group throughout South Asia, starting in India, but it is important. I have learned an enormous amount by working with Suresh Chandvankar,

who is the head of the Society of Indian Record Collectors, a passionate collector himself.

Among the things that I have learned is that there may be as many as one to three million disc sides, 78 disc sides that were recorded in India. Not big numbers by comparison with what we are hearing about for some of the other institutions yesterday and yet that is a mammoth task if one thinks about identifying those recordings, prioritizing them, and then beginning to make copies for public access.

And then finally in the South Asian subcontinent, I would like to say a word about our commercial partners. Commercial I use in loose terms because one of our closer partners, the founder of Peninsula Records, defines his company as a not-for-loss corporation, not necessarily a not-for-profit but he is in it for the public good as well.

And so there is a collegial spirit that I think is particularly strong and a great bond that is developed because of a shared sense that the

resources, the audio, the sonic resources of South Asia should be more broadly available.

But if I move beyond this Peninsula Record linkage, I would like to also highlight as one other example of a commercial enterprise, the Sri Lanka Broadcasting Corporation. This is what used to be known as Radio Ceylon. They have a fantastic archive. I will come back to talk about the problems of working with government agencies a little bit later but, fortunately, in this instance, Deutsche Welle has been able to provide not only money but also equipment to begin digitizing what was a set of records that was about the only game in town for all of South Asia into the 1960s.

The All India Radio had formerly put a block on the broadcast of certain kind of recordings during that time period and one hears tales still about people going out listening to Sri Lanka to Ceylon Radio to get the Bollywood sounds that were not available over All India Radio.

so, it is those popular recordings, as well as classical recordings and in all of the

languages, not just the languages of Ceylon or Sri Lanka that are contained in this archive.

So, a few projects, then, quickly described. All of these, all of the projects I will be describing really are closely connected to what we call the digital South Asia Library. Since 1999, we have been building this, the digital South Asia Library as a platform for delivery of resources. It was begun as an initiative, primarily because we found that there were almost no reference resources that were available for the study of South Asia, even 15 years ago. And sadly, I have to say that there is relatively few, if one compares the digital resources available for the study of South Asia in contrast to what is available for East Asian studies or Latin American studies, let alone the study of Europe or the United States.

So, as I say, we have focused on reference resources. By that I mean such things as dictionaries, historical bibliographies, statistical compendia, atlases, and such like.

Now, having achieved a bit in our making

available these resources for the study of South Asia that are of a reference variety, we are prepared to move on in a much more robust way into the world of audio.

So, moving into a few specific projects that are in beginning stages or are in advance planning, I want to say that all of them have benefitted from IRENE or will stand to benefit in an important and material way from our linkages with what you have already so wonderfully produced and what is still being developed by the two of you by Lawrence Berkeley Lab.

So, I mentioned very briefly that we are working closely with the EMI archive but what does that mean? It means specifically that the Berliners, and we heard about those yesterday, in addition, the earliest gramophone company productions and all of the HMV recordings, as well as some subsidiaries, smaller labels, are within our sight.

Now, how are we going to approach this? Our plan, as I say, based on contractual agreements

already with the EMI archive is to begin by creating metadata. Fortunately, one of the artifacts that is contained within the EMI archive is a full set of not only all of the catalogues that were produced in India, starting in Dum Dum, just outside Calcutta, their first plant, but additionally, all the release sheets that were produced.

Now, I mention this because each of the monthly release sheets contained invariably a full transcription of all of the contents of the recordings. So, by a one-two sort of pincer action, we are going to be able to describe what was produced at least by the gramophone company in HMV and, simultaneously, develop the full text, that is a digitized version, a searchable version of the full text of most of those audio recordings.

If I move on to a second example, with the support of the National Endowment for the Humanities' current project that is running to support our work on addition of new dictionaries to the digital South Asia Library under the digital dictionaries of South Asia, we are beginning to

expand our scope. And instead of just thinking of text, we are imagining that we are going to take over the course of the next two years an interlinking of historical audio recordings of texts, those texts being cited as examples of usage in the definitions of the dictionaries. And in particular, we are going to be working with the great Sinhala-English Dictionary published by government of Sinhala. It is a 46-volume dictionary rich with examples of usage.

But we are imagining, in addition to putting the head words, pronunciation of head words into the public view, having that link so that people can hear what it sounded like to have recitation of text in Sinhala. It will have interesting pedagogical consequences.

Moving to another example, we have had now running for two years of pilot project, we call it "Audio Cultures of India: Rethinking the Sound Archive." It is a pilot project. It is just coming to an end and we are moving into an implementation stage.

We have been fortunate to work with colleagues not only in the United States but from South Asia and from Europe in rethinking what it means to bring together in interesting ways not only sound but also the associated cultural artifacts. That includes text and it includes advertisements, images from HMV from the early 20th century, for example. It includes instruments and not only images of instruments but different ways of thinking about instruments as those connect into the audio and full text.

So, in conjunction with our colleagues who are computation experts, we are beginning to see ways in which it is possible to bring together these artifacts into a meaningful whole. Some of you in this room, I see, are old enough to have remembered Mitch Miller and the bouncing ball as Mitch Miller presented, so you could follow along with Mitch, hearing the sound but also seeing the text screening underneath. We think something like that is fairly easily accomplished by synchronizing the audio with the text.

But what we are imagining and, when I say we, I mean two really fine colleagues in ethnomusicology and an anthropologist, we are beginning to think about what it means to invert the whole idea of creating a history. Instead of creating a history by using music or by using musical instruments, we are trying to think of ways in which the music itself and the instruments can stand as history. A strange inversion and not enough time to go into it in detail but it has been fun to play with.

As I say, we are moving on to the next stage an implementation grant. Fortunately, we have received generous funding from a local body called The Neubauer Collegium for Culture and Society. One workshop held in Chicago was followed by another in Delhi just last year. Carl, we were fortunate to have you there with us and we are looking forward to your continuing participation as we move onto our next workshop in Sri Lanka.

Another project just getting underway is with some of the same collaborating partners but

an expanded set. This is called the History of World Music Recording, a preposterously large and ambition project by its title. It is funded by the Mellon Foundation and it is money that we have received indirectly through the Humanities Without Walls Consortium. This is a group that is based within the CIC. Some of you may know the Committee on Institutional Cooperation. It is a group of, essentially, the land grant universities plus a few others in the center of the United States.

So what is it we are doing? In this case, we have linked up for this pilot project, another pilot project, with colleagues at the University of Wisconsin-Madison, the University of Illinois Champaign-Urbana and we are taking a look at what started in the United States and, in fact, in the Mid-West with the Columbian Exposition. In 1893 in the waning days of the Columbian Exposition in Chicago, there was a team sent out headed by Benjamin Gilman. And Gilman and team made 103 wax cylinder recordings. These were recordings that were based with the exhibition spaces and the

peoples who had come to Chicago. So, this included Kwakiutl from the northwest coast of North America, people from Java, and folks from Turkey, Lebanon, and also South Sea Islanders.

Now, some of these have already been digitized but I think using the IRENE system, we are hoping that it will be possible to come back, think about those wax cylinder recordings in new ways and possibly extract better quality off of the recordings.

We are moving out, historically, along a time line that takes us to the 1930s. So, if we think of other bodies we are trying to incorporate, it certainly includes the John Philip Sousa collection at the University of Illinois Champaign-Urbana. Sousa, for reasons I still don't quite understand, decided to deposit all of his materials, including his recordings at the University of Illinois Champaign-Urbana.

But then again, we are thinking of ways in which the recorded sound can be interconnected meaningfully, once again, not only with the texts

about also with instruments because a sousaphone, you might not be surprised to find, is one of the instrument that happen to be present in the Sousa archive.

If we think about moving forward yet further in time, our colleagues at the University of Wisconsin have taken in the Paramount Record collection. Some of you with interest, audio file interests will know Paramount as one of the great producers of race records from the 1920s and '30s, a fantastic collection.

So, once again, if one thinks about those recordings, the cultural setting from which these recordings emerge, I think we have got an opportunity to pull these things together in a meaningful way.

And if we look at the overall trajectory of our project, we are trying to think of resonances, what did it mean for someone to come to Chicago, to be recorded and then go back out to the world. And what did it mean for the world to come into Chicago through Sousa's collection of march music and

national music from all over the world. And what does it mean for resonances and circulations within the United States to think of recording artists being brought up from Louisiana to record in Milwaukee, Wisconsin and then to have their recording shot out around the world? Early stages but we are excited by what this means and the prospects that it holds. And again, it all depends on having the kind of equipment that is now within our reach, I think, that will allow for high quality audio to be captured off of historical media.

Maybe one last example, because time is waning here, is with the Berlin phonogram archive. Here, suffice it to say that under the Prussian government, wax cylinders were produced by almost all German officials who went out from Germany around the world. This was at the turn of the century, in fact, just before the turn of the century. E. von Hornbostel, who was the head of what became the Berlin phonogram archive oversaw this production. So, if someone went to the southwest of the United States as a German Official and

happened to record Navajo music, that made its way back to Germany. Or if somebody went to the southwest coast of India and recorded various kinds of music at the time, that was sent back to German or East Asia. It is an unbelievable, a phenomenal collection and we are looking forward to an application to the National Endowment for the Humanities under the joint NEH Deutsche Forschungsgemeinschaft Initiative that probably will be announced, a competition in about a year.

So, let me move on then to impediments. I will quickly run through these but I have identified six key impediments that we are facing, as we try to think about moving these pilot projects into production. Some of these resonate with things that have been mentioned yesterday. I will start by describing the inadequacies of the human infrastructure.

It is sad to say but if I were to produce an essential description of libraries and archives, I would say in South Asia they are underdeveloped, the staff are generally under trained, and the

people who I work with, unfortunately, are quite often treated as nothing more than peons. It is a very sad statement. And yet, there are notable exceptions and my colleagues who will be speaking later stand out head and shoulders above anyone else that I work with in South Asia as colleagues.

Number two, there is a dragon mentality, as one of my colleagues has described it, with private collectors. If you have a private collection, you want to keep it under wraps and I can appreciate that in some ways. People have devoted their entire lives to building collections of some of the earliest audio recordings. They don't want this dissipated by mishandling. And they know for a fact that if these collections were to end up in government collections, they would be mistreated. They would be abused. They would not be well maintained.

Third, government restrictions. These are government restrictions now particularly with regard to access to audio recordings into the digital surrogates. And here I will just give two

examples.

Prasar Bharati, which is the body, the government body of India responsible for All India Radio and for the television, the national television system has been involved in digitizing, poorly digitizing over the course of the last years what remained of the recordings that had not yet been overwritten. It was their practice to take tape recordings and to save money by overwriting them. And so we have lost some of the most important examples of early audio.

There is no plan and there is no concrete willingness to develop a plan to make these resources accessible to the public, sadly.

Or if I turn to the Sri Lanka Broadcasting Corporation, a group that, as I mentioned earlier, has done magnificent work with support from Deutsche Welle in beginning to digitize their magnificent collection, great colleagues there who are working in the technology section who are actually doing the digitization. But what I found is that a couple of steps up, there is a

confusion and a bureaucratic malaise when it comes to the question of how you would make these things available or even if you should.

Number four, I would say it is critically important that we are absent in trusted repositories in South Asia for physical or digital objects. It is fair to say that there are almost no trust repositories anywhere in the subcontinent.

Fifth, there is a complete inadequacy of anything that begins to sound like metadata describing audio recordings that have been produced or that are even now being produced. How do you know what was being generated and how do you begin to set priorities if you don't even have a picture of the broad expanse of audio recording?

And finally, funding is just woefully inadequate, if one look at the South Asian subcontinent, itself.

Some of these impediments, I think, are ones that we can address, ones that we are hoping to begin to address, we have begun to address. If one thinks about inadequacies of human resources,

my colleagues, Sundar and Suresh, have recently some funding that will allow them to continue programs of training archivists. I would say that the questions of inadequacy of repositories probably can be addressed by interconnection by trusted repositories in the United States and elsewhere, places like HathiTrust. And I think that we can begin to address the inadequacies of metadata through projects like the one that I described with EMI, where we will be taking all of the catalogues and at latest creating an historical bibliography, a discography.

And finally, what are our needs, very quickly? I would say that some of the needs that I have identified before coming here in connection with IRENE system have already been addressed. One of those key questions that I had in my mind is what can we say about the availability of the images that are created from the IRENE system or from the other systems we have been hearing about? And do we have any assurances that software will continue to be developed that will allow for more fine-grained

exploitation of what is in these images. I'm happy to say that it seems as though there is a plan afoot to address these needs and that is comforting to know.

What I don't know so much about yet is what it would mean to get more IRENE systems, portable IRENE systems that could be deployed in South Asia. Currently we have one and, again, you will hear more about that a little bit later. But if we are going to do the work successfully, not only in South Asia but if we are going to take an IRENE system, a portable IRENE system to Hayes just outside of London and begin working on those unique recordings that happen to be at EMI archive, we are going to require probably more than one of these recording -- the IRENE systems.

Beyond IRENE, I would like to say that the trusted repository question keeps haunting me and I don't think there are going to be easy solutions to this. But what do I mean by a trusted repository? I need a proven infrastructure, where there is adequate metadata, where there is openness

to mining, at least mining not to the repository itself but to the open component of the repository and that there will be information about the repositories that is open and accessible for people to discover these resources.

We are in early days of thinking about repositories and what they mean for digital objects. I am hopeful about the future but much more needs to be done before I will feel comfortable retiring and knowing that the efforts that have gone into work over there last decades are not going to be dissipated over time. They will continue to be available to scholars and to others in the public.

And our final need, this is really for a retrospective bibliography. I want to come back to that because I don't think we can make adequate decisions about priorities if we don't really know what the lay of the land is like in its broadest expanse.

So, for my personal purposes, I see the greatest amount of energy over the next to going into this creation of an historical discography that will

allow us to begin to think critically and in strategic ways about where we want to focus what is always limited money and limited energy.

Thank you for the time to speak with you.

MR. ALYEA: So, next up we have Sundar Ganesan from the Roja Muthiah Research Library. And as they were setting up his laptop, we heard some mating music. So, this should be good.

MR. GANESAN: A very good morning to all of you. At the outset, I would like to thank the organizers for inviting me and my colleague, Suresh.

I want to share an incident with you before I move on to my presentation. I come from Chennai, which is a tropical region. And we speak a language called Tamil and down south of Tamilnadu, in our state, in a coastal area, it is called Kanyakumari.

Kanyakumari is known for 100 percent literacy. This region, we conducted a lot of field work, we found a small library 20 kilometers away from the town of Kanyakumari in a remote village and we heard about this library that it was closed for

nearly 20 years.

And then we went into the village. A lot of people came there and they were intrigued as to why these people were coming from Chennai and they wanted to know why you were there. Then we talked to the head man of the village and somehow we persuaded them to open this library.

It was a beautiful library, a small one, about ten cupboards of books or periodicals, wooden cabinets with glass doors. It was locked. And when this man went to open one of the doors, all the books fell down. And to our surprise we found that there was no paper inside. It was all the spine, just the binding material.

I am sharing this instance with you because I want you to understand the context. We come from this kind of background. Originally, RMRL came into existence with the initiative of the University of Chicago, thanks to Chicago, we see the collection of Roja Muthiah and it was moved to Chennai and, in collaboration with the trust in Chennai it has been functioning for the last 21 years

since 1994.

Roja Muthiah library was primarily focusing on printed material. When the collection was moved to Chennai, it had about 100,000 items. Now, we have 300,000 items. And during all the period while we were expanding the collection, we found that we should also expand the scope of the collection and we started collecting audio material as well.

Now moving on to archiving audio cultures in India.

India has a rich tradition of music. The classical music in India can be broadly classified as Hindustani and Carnatic. Both have vocal and instrumental.

Apart from these, each region has its own traditional music called folk music. In older days, everything was expressed in terms of music and poetry instead of speech and prose. This resulted in a repository of folklore which was passed on through generations. Mythical stories and ethics in India were dissipated to the general public

through dramas and storytelling events, which took place in temples and in public gatherings.

Most of the stories were told in poetry form and are accompanied by local musical instruments.

This is a kind of a folk dance and a theater performance, a very old theater performance. And this is another folkway of storytelling through songs. They have a bow instrument through which they create music and sing a song and tell a story. And here I have a title page of a ballad, which was printed in the early 20th century. It is about toddy shops and coffee shops. At the beginning of the 19th -- 20th century, when these books were printed, they were representing what was sung and then it was printed. And after that, this tradition died off.

This particular ballet talks about how coffee shops were replacing toddy shops. And the women at home are very happy that the toddy shops were closed, were getting closed, but the men were not very happy about that. So, it is about that.

Let me play a small music.

(Audio played.)

MR. GANESAN: It is another folk song. It is a genre called Tamash music, meaning comedy music. There is usually a message in it. This tradition has died off completely.

Then, with the arrival of cinema in the 19th century, new genre songs emerged. Early films in India had too many songs. Something like the European ballad when there was a reason to be happy or sad, the artist would break into a song. Early films were considered, essentially musical. Diversional songs are recited in temples and houses. These are some of the examples that I am providing here.

This is M.S. Subbulakshmi. She is no more. She died just a few years back. She is an exponent of comedic music. Of course you all know Slumdog Millionaire.

In the twentieth century with the rise of political moments all over India, the last number of public speeches were given by leaders, which were

recorded but not archived very well, again, I am only providing some samples, which broadly, from the audio cultures in early India.

Up until the arrival of audio storage medium, music in India has been passed to the next generation orally and distributed to the public through human interface. Even though mediums to store audio were invented much earlier, gramophone records were introduced in India in 1902. With the arrival of storage medium, all genres of music were recorded and sold by the gramophone companies. India was seen as a good marketplace for this business.

During initial days, many short-lived Indian companies and foreign companies made records. Some of the early recording companies in India are The Wellington Cycle Company in Bombay, the Binapani Recording Company, Calcutta, the gramophone company Calcutta, and the others are there that you can see.

Shellac records were initially released as single side in 7, 10, and 12-inch diameter size.

From 1908 onwards, double-sided records became the norm. Initially 78 rpm records were pressed. Later, 33 and 45 rpm records were issued.

As technology grew, audio medium changed from gramophone records to spool tapes, cassettes and now in digital mediums. Storage capacity and clarity also increased. It is interesting to note that the storage capacity of the medium changed the music tradition. When new technology was introduced, it restricted public performances to shorter duration. This changed the audio-scape from a 3-hour performance to almost three minutes. Also, many folk songs were changed and recorded according to the wish of the gramophone companies for the new, emerging consumer.

Today, we have only the recorded versions and we don't know the original version. Nowadays, in most of the places, the practice of singing folklore has become obsolete. Hence, it became impossible to trace them. Therefore, early audio material has become the only source for studying early music forms and traditions.

Though early music is available in these gramophone records, the way the common people spoke in those days was not in these records. India is a diverse land, comprised of many castes and regions spread across the geographical area.

Apart from the differences in various spoken languages, each language is spoken differently in different regions (for example, different districts). Every 100 kilometers or 150 kilometers you pass, the dialect changes for the language.

Fortunately, this was documented in the late 19th century and early 20th century by the Linguistic Survey of India. Many recordings were made in the field areas all over India. These recordings have now been digitized by the University of Chicago and are available to scholars for research on their Digital Storage Library website at the University of Chicago, the British Library for this initiative.

Nowadays, the local dialects are also changing rapidly because of the urbanization and

influence of the movies. Many local words are disappearing. So, it has become important to document not only the words but also the way it is spoken. This could be done as an extension program of the Linguistic Survey of India. The government of India, through an agency called the Central Institute for Indian Languages took up this program but for various reasons, it was not carried forward.

Jim Nye talked about the government institutions on the radio and the television state-run Prasar Bharati broadcasting institutions. I have heard from some people about the kind of cannibalization that is happening with all of the recorded material on spools in the past.

All India radio and doordarshan are the two government institutions, basically the only two institutions having a large number of recordings, both as gramophone records and in spool tapes. Most of them are exclusively recorded in their studios. Unfortunately both are not preserved well. The government set up a high level committee to provide direction to preserve them for posterity. By the

time it started, the government changed.

And Jim also talked about the way it has been researched. I'm not going to talk about that.

Now, I want to give a brief background about the private collectors. There are a few private collectors who have collected gramophone records as a passion and for preservation. One important man is Mr. V.A.K Ranga Rao, who is in the early 80s now. He has got over 45,000 records which he has been collecting from 1950s. He comes from -- he has a cinema background. He comes from one of the cinema families and also one of the kingdoms, early kingdoms from Andhra Pradesh called the Raja Baahubali. His collections comprises records from all genres that has been published in India.

The next one is Mr. Sunny Mathew he is from Calicut in Kerala, who has got about 25,000 records. He has now sought support from the Endangered Archives Program of the British Library for digitizing a component of his collection.

And there are much more. Mr. KRV. Subrahmanian, Annopoorni Veerapan and a number of

people, they have actually deposited their collection to the Roja Muthiah Research Library for digitization and also to provide access to people. And these are private recordings and they are not in the public domain yet.

If we talk about institutional collections, archives of Indian Music in Bangalore is an initiative by an individual called Vikram Sampath, who is supported by the co-founder of the IT company Infosys. Mr. Mohandas Pai. Vikram Sampath is also author of three books. His first book is *My Name is Gauhar Jaan!* which received wide accolades. So far, he managed to save about 10,000 records in his collection. And this dates back to 1902 and he just started digitizing them.

The Archives and Research Center for Ethnomusicology some of you would know about this institution, who have attended seminar a couple of years back in association with IASA. It was organized in New Delhi. This Center has about 128 collections of field recordings in its archive.

In addition to these, the Center has an

extensive collection of published recordings, ranging from classical music to folk music and popular genres from all over India from 78rpm discs to CDs. There is a small but growing collection of published world music as well.

You see the other institution is Sruti. Sruti is no longer functioning as an archive but I thought I would mention Sruti because the man behind Sruti was a visionary. By the time he assembled everything he wanted, he even got a piece of land. He raised money to set up this institution, but unfortunately, he passed away. So, he couldn't realize his dream. The good thing is, the collection has been donated to the Roja Muthiah Research Library. And then let us see the Kalakshetra archives. Kalakshetra is a music and dance school in Chennai run by the Government of India. This center has a collection of gramophone records as well as spools. The spools go back from 1930 onwards. Recently, the collectors' archives were supposed to digitize their material and we have helped them to digitize and we hold a copy of the

digital records.

We cannot ignore the role of scrap and antique dealers. Scrap dealers play a pivotal role in the circulation of gramophone records and players. Discarded gramophone records and players are collected and sold by them to antique dealers, people who are interested in gramophone records and players purchase them from the antique dealers.

And you can see how it is stacked. This place in Chennai called Chor Bazaar. Chor Bazaar is thieves' market. So, you get all kinds of material. People jokingly say that you get everything except a father and mother there.

And this is an antique dealer in Delhi and see how it is stacked.

And there seems to be a new heritage movement that is catching up in India. And a lot of people talk about heritage, preserving things. And on both sides, you see these people selling such stuff.

This is a private collection in Chennai. I didn't want to name the collection but you can see

how it is stacked. I want to show these are some of the challenges we have been facing.

When setting up an audio archive, James Nye talked about this, that there needs to be a decision to taken that only stand-alone audio material would be archived or materials associated with audio, such as videography and print materials, such as cinema song books, and cinema posters to be archived. Preserving these materials make the archive more comprehensive.

Let us take the case of cinema song books. During the early period of cinema, songs occupy a major part of the Indian films and appeared more frequently than the movies that are taken now.

In those days, it was a tradition to publish cinema song books while releasing the movies. Many people used to buy and read lyrics while listening to the song in their gramophone records. Now, these old cinema song books have become an important source of research material. The reason I say this is because the films are not preserved anymore. So, what do you do? So these

are the only available material. Many of the words in the lyrics of old films have now become obsolete. Also, it is difficult to understand the words by listening to songs. In such cases, the role of cinema song books are very important. Cinema song books also carry information such as singers, lyricist, production, director. Visual mediums, such as posters, provide the context of the songs/ movies.

I would like to show a cinema poster. This of course is a jacket of the record. This is a cinema, early cinema poster, again. This one again, is a cinema poster.

This one is a very interesting one. This is of a small documentary film taken by the famous American director, film director called Ellis R. Dungan. I want to play a small portion of this.

(Video played.)

MR. GANESAN: Well, as you have seen this short clipping, there is a fortune teller who goes to every house and predicts something and gets

-- he is paid with something. That is how he makes his living.

This culture is lost completely. Now this current generation cannot see this practice anymore in India.

As a school boy, I have seen this happening. And while I watched this film, and you will also notice the background is filled with music. We cannot hear how this man foretells or what he talks to the lady. But as I see this document, in my memory displaying how this person would do it, but what I am trying to convey here is this tradition is lost and how do we capture this moment?

While the director has done a wonderful job of capturing the video, he has lost the audio part of it.

Now, the latest development in the area of audio preservation is the assembling of the IRENE, equipment to digitize audio records without using a needle. I am not going into the technical aspect which my colleague Suresh is going to talk about. Thanks to Carl and Earl, who have assembled

this and thanks to the National Lawrence Berkeley Laboratory for this.

We are happy that RMRL has one such piece of equipment. The entire country in India is looking upon us to start working on this full-scale, using this full-scale. We have been receiving a lot of calls, especially after Carl visited India. He was interviewed and his interview was published in a national magazine called *Frontline*.

At any rate, while this is a success, I hope, scientist would also focus on similar equipment for developing a non-contact method for digitizing audio spools. This helps in retrieving and preserving a huge amount of audio information. The other day when we were visiting the facilities, the audio facilities at Culpeper, there was a discussion about this, which one to take first, the audio spools or the records, which one. Well, anything can be justified.

Now, I want to talk about support. Support is a very important aspect to carry out preservation activities. There was a presentation

from the National Endowment for the Humanities, NEH yesterday. I was glad to listen to that presentation and the kind of support it is extending. It is not just NEH, a number of agencies, funding agencies, both in America and Europe, like the Endangered Archives Program of the British Library, very thankful for their support. They support a number of initiatives in South Asia but philanthropy in India as such is not happening in a big way, especially for libraries, museums, heritage institutions. That is the point I want to make.

So, what do we do? You know when we talk about philanthropy for such areas, it is always when you go and ask someone, they will say go to the Tatas. When we come to the west and ask for support, they say all the money is in India and China. Why are you coming here?

So, this is the case. Thankfully, the Government of India has come up with a program called the corporate social responsibility to which it is made legally compulsory for corporations making a profit of more than a certain percentage to spend

two percent of their profit on philanthropy activities.

Until last year, libraries and heritage institutions were not part of that. But thankfully they have also included these institutions through a law. It is mandatory for them to support but the corporates have still not got together and decided to support this institutions. They are still deliberating on this aspect.

I sincerely hope that there will be some clarity there and we need more scholars and archivists to come together to articulate in such a manner that this can be conveyed to corporate houses so that it becomes easier for them to support us and also for us to approach them.

Thank you very much.

MR. ALYEA: We'll now hear from Suresh Babu.

MR. CHANDRAN: Good morning. I welcome you all for my presentation. And I am glad to present my experience with IRENE in tropical climate like India. Out of five machines so far developed,

one machine is set up in Roja Muthiah Research Library, Chennai. IRENE came to RMRL one and a half years after Mr. Sundar visited Lawrence National Berkeley Laboratory for training.

It was from memory and with the photographs of the assembled IRENE sent by scientists at Lawrence National Berkeley Laboratory, we were able to assemble IRENE.

As you see in the image, IRENE was set up on a raised sturdy platform. No pneumatic isolation was set up. We searched locally for a low-noise compact air compressor. We could not find one. We contacted Newport India, and found it was very expensive. Locally, we found huge nitrogen generators which doesn't suit IRENE, so we did not use one, but we did not experience any vibration problem so far.

Configuration was done online with remote support from Lawrence National Berkeley Laboratory by Dr. Earl Cornell. We used Skype and Teamviewer support for remote configuration. From Teamviewer we got remote access. We wait for the

image to load. Dr. Earl says just open. On the right side, my right or IRENE's right? On the right. So, that is how it is fun working online with Dr. Earl.

First I-Program was configured. Then our IP address was altered to communicate with XPS and Labview and IRENE program was set up.

On initial stage, focus and scan was not happening. The communication rectified between camera using measurement and automation program. Parameters adjusted to grab and snap the image. Scanning was done using Labview program and tracing of the image, converting and merging into a wav format was done through IRENE program.

After all hurdles, we were able to record our first song from IRENE from a 78 rpm disc. It is a 1940's Tamil movie, Thiruneelakandar. The song starts with Unnalagai kaana iru kangal pothathu, meaning "my both eyes are not enough to admire your beauty."

So, did you see the poster of that man? He is the romantic hero of 1940. He sang this song.

So, I have not used filters with this song. It is a raw format from IRENE.

(Audio played.)

MR. CHANDRAN: Now you can hear the second song, which I recorded from IRENE, the reverse side of that gramophone record.

(Audio played.)

MR. CHANDRAN: I'm just waiting for that man to sing. So, this is a 33 rpm record. I was advised to test as many records to get more exposure and training with the IRENE machine. On a trial run I also tested a 33 1/3 rpm vinyl shining disc and was able to record a good quality sound.

(Audio played.)

MR. CHANDRAN: I was also taught to trace manually. I tried 78 rpm broken disc with manual tracing with the IRENE program and could retrieve quality audio. This is a three piece broken disc. I don't know whether you can see. I just assembled it. The cutout sound is the broken part.

(Audio played.)

MR. CHANDRAN: This photograph shows the image and the setup, how it looked when the first song was recorded using IRENE. The people who were working with IRENE know what this is.

So, now let us see the challenges and how we did that. This is a print screen of an error message from Labview. This image was sent via email and remotely from Berkeley to get support to rectify it.

At one point of time, we were not able to get proper images from IRENE. The focus was dull and IRENE program could not trace properly. We found that it was due to the bulb inside the Dolan Jenner was getting dull.

So, from Berkeley, two new bulbs were sent and replaced the old one. But the bulb was not so effective to provide required lighting for the image. We then found the Dolan Jenner was creating problem.

Then rotation stage stops at 88 degrees. Remotely, it was checked and they advised me to remove the platter from the stage and set the stage

parameter to factory default. Even after trying that, the stage did not initialize. Rotation stage problem then got fixed by changing the parameters remotely.

Then we found the camera also gives a wash-out image. Could not verify it was the camera or the optic which was causing the problem.

Fast focus window was happening very late and spinning also was not proper. Here comes Jim. This time Mr. Jim Nye of University of Chicago, during his visit to RMRL, brought a new camera and light source (Lumencor).

New software for camera and updates for the Labview program was installed. We then found that the light spot was not right. So, new code, IRENE-2D2 was sent and installed and an adapter or the light source was also ordered.

After installing the new camera, I thought let me test my first disc again. So, let's see. You heard my first test with a lot of noise that I made before. Now, let's see.

(Audio played.)

MR. CHANDRAN: So, Dr. Carl, you know rotation stages problem so Dr. Earl Cornell corresponded with the Newport mentioning the problem with the XPS C-4 rotation stage and Newport provided some solution which were tried but didn't work.

Dr. Carl Haber, visited RMRL in December 2014. He tested the IRENE machine and found there was high humidity in the room where IRENE is placed. The air conditioner was too far from the machine. The adjustant room is a microfilm processing room. We live just three kilometer from sea and the relative humidity was around 85 percent.

Dr. Haber advised us to bring down the humidity level or to shift the machine to other area where humidity is low. He also took the faulty rotation stage motor to U.S. Newport and sent it back to RMLR after rectifying.

Subsequently, the IRENE was shifted, the repaired rotation stage was installed back in the machine and tested. Now the initializing stage works but when doing focus or scan, the initializing

gets disabled. Inside the rotation stage is fixed by changing the parameter. They also found the Trigger cable is not giving the required voltage. I have the Trigger cable here.

This is the current stage of IRENE at RMRL.

When Dr. Haber was in Chennai, he was interviewed and the interview was published in a national magazine *Frontline*. After that, we have been receiving calls asking for the recording service of the gramophone records. Some clients of the cinema music data of the family of the Carnatic music wants the service of IRENE. On a trial, I tested a 33 rpm disc of a cinema music director and gave them a sample output. The next day, the assistant of the music director contacted me and said the director listened to the output and said this machine is giving the original detail of the track that was originally recorded and the output from the stylus is substituting the sound details. That is interesting.

I told them more research on 3D model

of this machine is going on, so that next time I can provide better service for them.

There is another challenge for us for preserving the image from IRENE which need more disc space, about 320 MB in one image. Even though we are getting terabytes at lower cost, they need to be monitored.

IRENE technology has revolutionized audio preservation. I hope we will be able to cater to the audio world with this equipment.

I wish to thank the National Lawrence Berkeley Laboratory, University of Chicago and Library of Congress for this invitation. Thank you.

MR. ALYEA: Next up we have Carlene Stephens and Shari Stout. Is this -- they are going to use this? Okay. So you know how to use this?

MS. STEPHENS: Well, good morning. Thank you very much to the organizers for this opportunity. Shari and I are going to offer a case study on the use of IRENE. You will see from our presentation, hear from our presentation, that our

case study is simultaneously unusual and very typical. We are unusual because we have a very odd set of stuff. On the spectrum of stuff, we don't even call what we have libraries archives. We call these things artifacts. So, that makes us unusual.

What makes us very typical users in this case of IRENE is that Bill Veillette said yesterday, we are those people who don't want anything touching our stuff. So, IRENE is perfect for that.

So, I will just jump right in. Shari and I have been working with partners at the Library of Congress, Lawrence Berkeley National Laboratory to recover sounds with optical methods on some of the earliest audio recordings ever made. And those of you who came to the museum for the tour the other day, I apologize for repeating everything that you might have heard there.

Our efforts, so far, have focused mainly on a dozen experimental recordings made between 1881 and 1885 inside Alexander Graham Bell's Volta Laboratory right here in Washington, D.C. And I have a picture inside the lab from about 1884. And

this is one of their experimental setups.

Shari and I are going to split our remarks today. I will start, obviously, and give you some background on the project and play some mediated 19th century sounds for you and then offer some preliminary thoughts about the implications of reviving these recordings.

Shari will take over and she will talk about some of the collection-related issues that have emerged from this project because these things are artifacts in our museum, not archives and sound recordings.

We learned in the process of dealing with this sound recording project that we have, in our hair, some of the most significant objects in our museum and we are taking steps to treat them accordingly.

The dozen recordings we focused on so far are really just the tip of the iceberg, a very small part of the unique Smithsonian collection of about 500 artifacts that document the birth of sound recording and playback and that includes the work

of Bell, the work of Thomas Edison. And we also have a collection of Emile Berliner, other pioneers in the field.

There is the iceberg, our sound recording storage cabinet, experimental sound recording storage cabinet, some of the Volta contents, and of course, Shari, in the middle there. Most of the recordings in this cabinet have been considered unplayable and most of the content still is unknown. We have very sketchy catalogue cards. Yes, we still use catalogue cards in addition to our digital database. Most of this was considered unplayable and that is until recently.

Of course you recognize IRENE. You recognize Peter, Carl, and Earl. Since 2009, we have been working with the physicists and the Library of Congress here to recover sounds from these Volta Laboratory materials. And thanks to our partners, a short list of various funders, we have recovered sound from some of these things. The list of people who have contributed to this project in terms of content is much longer and I will get

to that in a little bit.

What I would like to do now is share a new look at Bell, the Volta Laboratory, an intriguing bit of this history. All of this emerging from this sound project and we are eager to share it.

I will be very brief with the history here because it is probably something that most of you already know very, very well but I think it is important to say that the 1880s was a period of hyperactivity in recorded sound, efforts to get to recorded sound, to invent processes and materials and media. And ironically, it is a decade from which was have almost no sound. So, we are contributing to that with this project.

Very, very quickly, to orient you for whom this is new material, there is the time line of the visual picture of recorded sound in 1857 on the phonautograph, the stunning moment when Thomas Edison invents a machine that can not only record sound but play it back. The improvements of Alexander Graham Bell and his associates at the

Volta Laboratory and then Emile Berliner who is credited with commercializing the disc. And it is really this section of this time line that we are focusing on.

That was the lightening round of recorded sound history in the early years.

Back inside the Volta Laboratory, what did we learn focusing on these recordings? First of all, when we started our project to recover sound from the museums, Volta recordings, we discovered there isn't a whole lot of historical literature about the lab. There are a few things. The last thing that was written about this collection in the museum was written in the '50s. And I don't know that it is significant but the man who wrote it was temporarily in the museum and then he became a monk. We hope we had nothing to do with that or maybe we should be glad we had something to do with that.

Second of all, we discovered -- we had to discover in the process whether IRENE, the specialized equipment our partners proposed to use, whether this equipment would even work on these

Volta materials. They are various, to put it mildly. They are various materials, various formats, various sizes. There is no standard format in a lot of the material. They pre-date standard format and they differ considerably, one from the other.

So, I think it is important to point out that we are using a 21st century experiment, a 19th century experiment.

For a third thing, we learned the present Volta project connects to Smithsonian history in a material way. And again, all of this could be elaborated upon at length but I am not going to do that. I will just say that on three occasions, February 28, 1880, April 6, 1880, and October 30, 1881, the Volta associates, and that is Alexander Graham Bell, his cousin, a chemist, Chichester Bell, and an instrument maker named Charles Sumner Tainter, the three of them deposited sealed tin boxes at the Smithsonian. The photophone experiments, their experiments with sending a sound

message on a beam of light, were in the first two boxes. And the third box had the graphophone, the original graphophone and related sound recording notes. They even deposited in the sealed box newspapers from the day that they sealed everything up to demonstrate priority of invention. They were not ready to patent but they wanted to be first in. And they went to the Smithsonian with these sealed tin boxes because the Smithsonian was, at the time, established as a spot, a foster of science and technology in the period. The head of the Smithsonian was the most prominent physicist in the country and Alexander Graham Bell had sought out his advice when he was trying to develop the telephone. So, there begins a very long-running relationship with the Smithsonian. Bell eventually becomes a regent, part of our governing body and, in the end, deposits the leftovers from the Volta Laboratory as gifts at the Smithsonian, which is how we get 400 some recordings, another hundred pieces of apparatus from the lab. We have all of that stuff.

So, the tin box is not necessary for a

patent fight. There are patent fights surrounding sound recording, as you all know. But the boxes languish until 1937 in what is variously described as the secret vault, the confidential archives. It is a safe outside the clerk of the Smithsonian's office. And here you see the boxes being opened in 1937 with the original materials inside.

Okay, so, in summary, these things that were in the box that came from Bell and the Volta Lab were once media artifacts and now we can use them as historical documents. These recordings offer basically eloquent voices that can guide modern scholars to an understanding of a crucial time when today's old technologies of sound recording and playback were new -- brand new. And all of this, of course, needs deeper analytical commentary but I wanted to be able to move on and play some of these sounds from the 1880s that were previously unheard, unplayable and also, at this point, mention that these things complement a body of documentary evidence that is here in the Library of Congress, the Bell family papers, which are more and more

online available. So, there is a considerable amount of background information available on the process.

And we had help from Patrick Feaster, who spent several months in our museum looking at our sound recordings and then correlating them with the written record in the Bell family papers and the Charles Sumner Tainter notebooks, which are also in our museum. So, it makes a very nice package of documentation.

Okay, so, I am not going to play everything but I just wanted to give you a sample. I showed you the weird material, the brass -- the wax on brass, wax on binders board, copper electrotypes, and then there is a sandwich of cardboard, plaster of Paris, foil. That is item number five on the slide. All of these things have actually yielded sound, thanks to IRENE and the efforts of our partners.

We have a variety of sound. To characterize this small sampling, I would say I am astonished how much Shakespeare there is. And we

have already been approached by Shakespeare scholars who are eager for this material. We released all of these sounds in two separate press releases and they have beaten a path to our door, which indicates there is an appetite for these recordings. A small sampling but we are already busy filling requests for information about all of these things.

There is also the mundane. The earliest disc in the box, the tin box, is a man's voice, unidentified, counting from one to six. And it is clear from the beginning that Bell thought of this device, the graphophone and the sound recording as a business dictation device.

So, here is the mundane.

(Audio played.)

MS. STEPHENS: Is Patrick here? Is Patrick here? Can you comment on the trilled R?

DR. FEASTER: So, the trilled R was kind of a standard piece of subject matter that the Volta associates used whenever they wanted to tell if a system was working at all. Because if a

transduction system was going to pick up any speech, it would pick up the trilled R. It was just very, very recognizable and very, very -- didn't put too many demands on the equipment. So, this was a test you would do just to see does this work at all. Is there any hope for this arrangement? But nobody had ever heard what that sounded like. You could read in the notebooks that they were using this repeatedly but, until we heard this disc and some of the others in this group, nobody knew that it sounded so very cool.

MS. STEPHENS: Thank you. Thanks. Very cool, indeed.

We heard this yesterday and unless Carl wants to hear it again, I am going to skip it. This is Mary Had a Little Lamb. You want to hear it again? Oh, my gosh. Okay.

(Audio played.)

MS. STEPHENS: Okay. So, then the first two recordings were from our first round of experiments. We don't know who is speaking.

In the second round, we got some voices

we could identify. There is documentary evidence that the voice you are about to hear is Alexander Graham Bell's father. This is the original graphophone from inside the tin box. It had to travel to Berkeley and then we got sound.

And you can follow along.

(Audio played.)

MS. STEPHENS: Yes, it is a little joke. But as people who came to the museum might have learned, it is quite literal, as well, because the machine, the original graphophone started life as an Edison phonograph. It is literally an Edison phonograph that they widened the grooves on and coated the drum with wax. So, it is a little joke.

And then we were able to identify what, to date, is the only confirmed recording of Alexander Graham Bell's voice. And the piece of paper on the slide is a handwritten, signed transcript, signed and dated of what is on the recording. Again, very mundane, a long list of Alexander Graham Bell counting. He starts one, two, three, four, five, and so on, then by hundreds

and towards the end he is repeating dollar amounts. And I didn't bring any of that. I brought the very end.

(Audio played.)

MS. STEPHENS: So, for those of you who want to make a pilgrimage to the site of the Volta Laboratory or Volta Laboratory, as Alexander Graham Bell says it, you can go to 1221 Connecticut Avenue today and have an Empanada because it is the home of Julia's Empanada. I think there is a bar there, too, called the Lucky Bar.

Okay, so, very quickly, what are we to make of these disembodied voices? As we were working through the various ins and outs of optical sound recovery, this is clearly an ingenious way to digitize and make accessible endangered, fragile, damaged recordings without touching them because they are in the do-not-touch business. This is thrilling for us. This is very important to those of us who have national treasures in our care.

And I have come to the conclusion that these mediated revival techniques are worth

pursuing because, and I am not sure -- yes, okay. In regard to our collection, we would otherwise have no sound. These would remain mute objects, no sound available, no content, inklings of content. This may seem obvious but the very existence of the recordings at the Smithsonian for a Century has not been enough to stimulate researching them, interestingly. They sat in the cabinet until 2009. We knew we had them. They were very well cared for but couldn't do much with them.

And so the availability of the sound has focused attention on these things in a way that we just, otherwise, would not have done.

The availability of the content then inspires us to investigate in detail through the material, the sonic documentary evidence, this formative period in sound recording and reproduction. We learned who spoke. We learned how they said it. We learned what they said and we are trying to figure out why they said some of these things. Clues begin to emerge about the internal inventive process of Bell and his associates, as

they worked through new technologies and tried to develop commercial avenues for them. They are clearly in this business for commercial improvements. This is not basic science.

And we learned more about the Smithsonian's role in fostering contemporary science and technology at the end of the 19th century and institutional history is one of the things that is important to us.

These recordings have a lot to teach about how Bell and his contemporaries conceptualize sound and orality. When they talked about sound, when they thought about sound, what were they thinking about? Remember that Bell's primary research interest was not electrical communications technologies, until he got to the telephone. He came from a background of research in the pathologies of hearing and speech. So, he had to study up to compete with Edison.

So, inventing communication technology was a second career for him. So, these recordings are beginning to illuminate these two parts of the

career.

Also meeting in those research borderlands are the methods of interrogating sources of all sorts, text, non-text, in our case, material culture. It is sort of the given among museum curators, students of material culture that one needs to read objects, to examine their physicality, interpret their content. And I guess the point that has come slamming home to me with this project is that one must not only look but also listen.

So, very quickly, what is next? We hope we will do more sound recovery. There is still roughly 400 more to go. We would love to have our own IRENE. We haven't found our own David Packard yet but we also anticipate more sophisticated research and interpretation from scholars inside and outside the Smithsonian. There you see Patrick pouring over the recordings and he has produced the discography.

We also were able to generate and exhibition, "Hear My Voice," which is open until

January 2016, if you haven't had a chance to see it. And late breaking news that didn't even make it onto the slide is that our museum archive center holds the Charles Sumner Tainter notebooks, as I told you. And they are now totally scanned. If you go to then entry in siris, S-I-R-I-S dot S-I dot E-D-U for the Tainter papers, you can pull up the scans and we are, as of Friday or last Friday, 87 percent done with transcribing them. And the transcriptions will be posted soon. In fact, you can see the ones that are done already.

So, okay, I am going to stop and turn things over to Shari, who will pick up on more of the physical aspect of the collection.

MS. STOUT: Hi, I'm Shari Stout and I am the Collections Manager for this collection but, more largely, for the Division of Work in Industry at American History and I work with Carlene, obviously.

I care for a large number of objects at the museum and the sound collection is just a fraction of that but it is one of probably the cooler

things I get to do.

Our collection, as you heard, consists of between 400 and 500 objects and the earliest portions of the sound collection. And just in case you are curious, the much larger collection of commercial recordings is in the Division of Music, Sports, and Entertainment, which is a separate entity from the two of us. And that is just due to how the museum divides up history and technology, and I can't really explain it.

For my part of our talk today, I am going to talk about the challenges of caring for the collections, which is a little bit different from anything else we have heard. So, I hope that is useful or, at least, entertaining and what we have learned that might be of use of to you.

And another note is that as a collections manager, I am focused on preventative conservation and museum best practices and not full-scale conservation. So, that is just a little side bar.

And as you will see, we do work with conservators and I have some pictures of some of the

conservation we have done for the exhibit. And so, as I said, my job is just a little bit different from some of everybody else here.

As Carlene told you, this is an experimental collection and that meant that the Volta associates were using a lot of different materials. And so I, too, have a slide of the weird materials. These objects are strange and wonderful but they are also sometimes a collections management nightmare. They are sort of a challenge to understand to house and maintain and especially, sometimes when they are not holding up well.

And now we have a new special challenge is to work with Carl and Peter to determine if they are good candidates for sound recovery. So, you will notice the line with the blue background there is surrounded with government red tape. So, it has been with us for a while.

So, here are some that are not good candidates for sound recovery. So, we just have everything in the collection but those are interesting, too, in their own way.

So, what can we do? First, we can try to get to them before deterioration takes place. And in some instances I mean that we can recover sound from them and we have all heard a lot about that. And that is, as I say, that is a new thing for us to sort of get our arms around because, as Carlene said, normally, we wouldn't do something like that. And in other instances, I mean that we can take steps to use preventative conservation to stop agents of deterioration. And one way to do this is to remove the objects from original housing, which I know is something everybody is grappling with.

I work with graduate museum study students from George Washington. We have a practicum class and we teach rehousing techniques. So, that is a good chance to work with the sound collections.

And we have some kind of odd collections from the Volta Lab here that came in a cardboard box. And the acidic nature of the cardboard, of course, is bad, but you will also notice there were these

little cones in the top of the box. And so each time, I'm sure those were meant -- they were supposed to do something good but every time they were going in and out of there they were chipping the cylinders and so we have chips from the cylinders. So, you will see when we made the new box there, the students actually made little boxes for the chipped off bits. So, you will see we made that nice new box.

And the important point I want to make here is because we, at this point, know so little about the collection or we are still trying to glean a lot of information about it, I am trying to retain all of the original housing for it. And so that seems like kind of a strange thing to do, especially when it is going to double the amount of space and we are running out of it. And Carlene showed you our crowded cabinet. But it is absolutely imperative not to throw any information away. And so we are saving everything and you will see on that bottom picture, I even had them take a picture of the original box and the original order. So, I had them replicate absolutely everything.

So, these are just some examples of some of our original housing. So, that is a really great, cool wooden box but terrible housing for those cylinders. So, these are some of our candidates for rehousing.

And there, we have one of those concern grand cylinders and it is a candidate in the queue for rehousing but we are also testing it with an A-D test trip. We know the felt is bad but we are also just curious to see how acidic that felt it.

And then on the other side, those are some rehoused lids for some of the original glass discs. And we think they probably have Alexander Graham Bell's handwriting but we are not sure, but they have somebody important's handwriting on them so we are keeping them. So, you know, it is the Smithsonian; we can't throw anything away.

But now this also is causing, in addition to the space problem, it is an inventory issue and that now we have a container and the cylinder separated and we need to keep everything together and track it. And now they are considered objects

also.

So, this is sort of what I can do at my level but here you will see what happens when we can introduce the conservation lab into the mix. Here, we are doing an XRF test on one of the aluminum discs that went into the lab and so she was able to learn a bit about not only the foil but also the adhesive with the foil.

The opportunity for an exhibition opened the door for our first in-depth conservation of the Volta collections but only for those dozen pieces. Due to the funding priorities of the museum, collections and storage are sometimes not conserved as often as we would like because the priority has to be placed on objects going on exhibit alone. For "Hear My Voice" exhibit, we have been able to secure a conservator's treatment for the items on display. We have also conducted a conservation survey for the entire collection to determine what needs urgent treatment and what is stable, thanks to GRAMMY Foundation Grant but that leaves most of the museum's collection of

experimental recordings still in need of treatment.

So, here is some more. Just removing grime from the barometer disc there. And that is Dawn Wallace, who is our conservator. And we had a huge catalogue number in the middle of the disc, which is how we used to do things. So, she is removing that.

So, as Carlene said, how are we recording all of this information? Our museum has been working for the last several years inventorying collections and updating our collections information system or our CIS as part of that process. And each object is photographed, catalogue numbers are reconciled and catalogue cards are even photographed and put into that system so that we can keep our original information. So, there is our catalogue card and there is a screen shot of our system.

So, the cards are scanned and we have all of our information. We are trying to get everything into one place.

So, now that we have sound files, we have

to figure out how to manage all of our digital assets and our digital asset team is sitting right over there. So, if you have questions about how we manage our digital assets, you can talk to them because they can answer questions.

We have to figure out to manage all of that information and especially how it goes onto the lab and through our Smithsonian Collections on the website. We not only wrestle with rehousing and managing the collections physically but now we have to figure out how to manage our digital collection.

We have to collaborate more effectively with all of our colleagues, in order to share all of our information the best way we can.

So, what has working with the Volta collection taught me about caring for sound collections generally? It is not always just about the cylinders. Like all collections, a single object is often part of a much larger, important, or interesting story and that is often the case with everything that I work with at the Smithsonian. In this case, it is all of those and we are just

beginning to scratch the surface. There are many more recordings for our team to work on. And at some point, I hope that we can work with some of the sound apparatus from the Volta Lab and this is one of the tantalizing machines that came out of the lab. It has got a waxed tape on it.

And that leads me to my conclusion, which is just that it is always important to look at the bigger picture. And as a collections manager, it is often my job to focus on fine detail, the accession number, how many parts do things have, do I have room to store it. But what we have learned from working with IRENE and the Volta Lab materials is that he details are very important and it is important that we always look at the larger and the bigger, richer picture.

MR. ALYEA: Does anyone have any questions?

DR. HABER: Actually, it is more of a comment. Concerning the presentation that Suresh gave about his experience and the experience of the library in Chennai, working with all this equipment

-- Jim, you are supposed to get up there.

So, I was making a comment about Suresh's presentation. So, yesterday we heard from the National Endowment for the Humanities about ways to support various efforts and mention was made about international collaboration. So, the way this kind of got started is that Jim saw this as something that could -- these technologies as something that could benefit these collections. And at that time, we were applying to IMLS for a grant.

And Dr. Anne Imelda Radice, she was the head of IMLS and IMLS had a priority about international projects and international collaboration. So, it seemed like a good match and the institute supported it. And the idea was to build a machine that was relatively portable because we were going to get it over around the world and get it set up there.

And you heard the experience that Suresh and colleagues had. So, on the one hand, we got this machine built. We got it halfway around the world and set up and running and they were able to take

data. But it was in a tropical climate, various parts failed. Things had to be fixed and so forth. And of course, it is a 12-hour time difference and how do you do all of that?

So, there were just many practical concerns. And so it was one thing to get the funding to do this but what you learn, obviously, is something like that has to be sustained at just some minimum level so that you can do replacement of parts, that you can maintain systems. I mean thing fail. It just naturally happens with electrical and mechanical things.

So, it is one thing to do an international project and it is very attractive. You do the thing but somehow it doesn't have the same cache to just sustain it. But unless you can sustain it over the years, and it really doesn't take that much, we need to make a trip maybe once a year to deal with upgrades. We need to be able to replace parts. And when you try to find a way to do that, it doesn't have the zing of a cool proposal but it is so important if you are going to keep this thing

going on a day to day basis. Just little things end up becoming big problems. So, somehow to find a way to do that, we basically had to do it out of pocket and just anyway we could figure out how. But when we talk to the agency, I want to make the point that finding ways to just sustain it actually has just as big an impact as the initial commitment.

PARTICIPANT: On that note, are there any comparable situations or technologies that came out of the Berkeley Lag that had this similar path that you had to figure out? And how does it typically go? Are there analogies?

DR. HABER: You mean outside of --

PARTICIPANT: Moving from the Berkeley Lab out to availability.

DR. HABER: So, I mean I can speak to the experience that we have in say a field like high energy physics. So, in high energy physics, people from places like Berkeley Lab but from institutions all over the country participate in large international collaborations to build some huge piece of experimental apparatus that is at CERN in

Geneva, Switzerland, or Fermi National Accelerator Lab in Batavia, Illinois, and lots of equipment, special, one of a kind technically complicated stuff gets built like IRENE but bigger and more expensive and gets sent from labs like Berkeley and Stanford and others to these central locations. There is software. There is hardware. There is firmware. But it is recognized by the funding agencies like the Department of Energy and the National Science Foundation that it is not enough just to build the thing, there is also maintenance and operations. And that is part of the budget and part of the funding. And the projects are carefully reviewed and there is a lot of oversights but there is post-ops. There are graduate students. There is travel budgets and, of course, there is a lot more people involved and we are talking about projects that are, in the end, tens to hundreds of millions of dollars but it is totally recognized that, particularly, when you build a one of a kind apparatus, that there are teams of people that maintain them.

The other example, obviously, is a private company that has a customer service department. But we can't -- we are not making a product where we have an inventory room and we have the reps all over the world that are just sitting there waiting for the calls to come in.

I think the model is closer to the one of a kind scientific instrument. The worst case is like the Hubble Space Telescope, where every time you have to fix it, you have to send somebody up in a rocket. But that is foreseen also. Now, we don't have to send rockets, fortunately, to do this but it is like that.

MR. NYE: I have a few thoughts on sustainability following on Carl.

Obviously, -- oh I'm sorry.

PARTICIPANT: Sorry, I have to comment on Carl's comment, if you don't mind. The charge-coupled device that was invented, that was developed by Fairchild to capture the residual particle collisions got commercialized into the imaging devices that we now use to do this kind of

thing. And it was really only invented as a data-taking device for high energy physics experiments.

And I will say something about appliances later.

MR. NYE: There seems to be a major difference between the kinds of institutions that you were describing here, Carl. Obviously the sciences -- well, let's take Smithsonian as well, has its own predictable source of ongoing support that come to maintain operations, once they are deemed to be important. Whereas, if one moves into the field of the softer sciences, if you will, that is, those kinds of engagements like the portable system, the portable system, the portable IRENE in Chennai, we are dealing with fragile institutions that are operating on the basis of philanthropic contributions or other means of maintaining themselves.

But it takes me back to an earlier era in Ford Foundation's activities where they had what they called, at one stage, tie-off grants. These

were corpus funds that were provided to maintain activities beyond a period of experimentation.

If I think about NEH and maybe I am going off in the wrong direction, but there are challenge grants that effectively serve similar purposes. That is, you can apply for a challenge grant and that allows you to set up a corpus fund or an endowment to maintain something longer term.

So, what I think we are going to have to do is be more aggressive about challenging Ford foundation to return to its practices or engaging in the three-to-one matches that are necessary to get a challenge grant up set up to ensure that these activities, once begun, can be sustained longer term.

PARTICIPANT: I terms of funding, it reminds me of a story. I had the good fortune to work on, in 1998, the preservation planning for digital AV materials for the Library of Congress. And I will never forget when I had to make a presentation on that, there were people in the audience. One person stood up and said for God's

sake, what are you talking about. We need record sleeves and you are talking about digitizing things and putting up buildings.

And my response was, since my previous station at the Belfer Lab was based on soft money all the time, I said you need to think bigger. And I get really concerned when I start to think about standards into the future because if you think small, you get nothing. And it is very important to think of the importance of what you have here and to escalate your thinking on how you would leverage corporate support as well as other agencies to bring in sufficient funding to do what you really want to do.

When I first came in, I was literally talking to Peter and I said well, gee, I can imagine this research, that research, and this other research does now cost millions of dollars. My answer: So what? If you think small, you are not going to get what you need. So, I think moving forward, when you think about how you are going to raise funds, think of who is going to get benefit

from it. Will the government benefit? Will industry get benefit? Who gets it? And then look at multiple sources and you need a group of people who can think in those terms because I think Culpeper is not a bad outcome of thinking bigger rather than smaller.

PARTICIPANT: I have a question. If any efforts have been made to contact the entertainment industry and the film industry to use this rich source of music, I mean what if the next A.R. Rahman film, they put some of this beautiful epic lost music? I think that could be an untapped resource to also get exposure.

So, has any effort been made to go outside of the institutions and the academia and the foundations to tap into entertainment and the masses? The short-term answer is yes. Almost all of those assets that came out of Bollywood were components of what used to be called HMV in India. It is now called Saregama. In fact, the ownership of that particular cluster of assets has been transferred I think four times, I think, over the

course of the last couple decades. It is now in the hands of a very wealthy family, the Goenka family. And unfortunately, they don't see any financial gain coming from this that is adequate to permit full-scale digitization activities.

And in fact, quite a few of the original assets, the shellac recordings have been melted down. The stampers have been melted for the sake of the base metal. So, there is a challenge.

But again, thinking big is important. I think there is a challenge in approaching creatively those who hold the assets, in order to make sure the point is made about their value, their uniqueness and ensuring that we can have access in ways that are appropriate without violating intellectual property rights.

PARTICIPANT: There we go. So, Jim, in your talk, you mentioned HathiTrust. So the question I was going to ask actually I was also inspired by Suresh's comment around the need for better data storage and better curation of data.

So question A is what have we learned

in Hathi that might help this community think more globally about how we manage our data. But maybe question B, actually drawing on the conversation we have here is, have we learned anything about how HATHI has found sustainability and how we might approach that same question that we are discussing right now in this community.

MR. NYE: One very important factor here with HathiTrust is that they have now developed what they are calling the HathiTrust Research Center. It turns out one of the two people, the co-director, J. Stephen Downie at the University of Illinois Champaign-Urbana, is in fact keenly interested in sound, sound recordings and computational assessment of where recordings are and how one can go after gathering in metadata but then not siloing the audio recordings themselves, but instead, thinking creatively about how you can have dynamic access. He is interested, for personal reasons, how sound comes into play and how more sound recordings might be made available within HathiTrust.

So, I think the future is promising in that area. But when it comes to the sustainability of HathiTrust, we have got a different set of questions. You may know that it was started as an initiative by the CIC. And the provost at the universities kicked in, I think $5 million each in order to get the ball rolling. It is not much broader but they are facing their own problems of sustainability. And I have to say, in all candor, as much as I admire what is going on, I find it problematic and colleagues in South Asia find it problematic that you have to be a full-paying member before you are given the rights of access.

So, that is understandable. They have got a model that they need to maintain and I can appreciate why that is necessary and yet it is not an ideal solution. It may be a trusted repository for those institutions that can afford to participate and contribute their assets but I don't know that it is the long-term ideal model just because of its being locked for many people around the world. And I get complaints probably every

couple of weeks about why these resources aren't available to me sitting in Berlin or in Calcutta or wherever.

PARTICIPANT: Is there a model that helps a repository not have a game way then or some sort of box? I mean you mentioned, you talked about monetizing the collection in order to provide sustainability. That is in opposition to open access, which was the theme in part of yesterday. Because it seems like we, the library or information community, is kind of stuck in this position where we don't know which way to go. We value open access in an economic climate where that is not feasible over the long-term, in order for us to achieve our goals.

MR. NYE: Well, in bygone days, that might have been called the $64,000 question. Yes, I don't know. I certainly don't have any unique or magical suggestions on it. It is a vex problem and others in the room may have ideas about how to address it.

MR. DEANNA:: You haven't really,

nobody has really talked much about intellectual property or copyright here and it seems to me, in this community, certainly in the audio community, what you notice there any may public websites of sound recording and the reason is there wasn't a federal copyright law for sound until '72 here. So, all of that pre '72 here, I am assuming pre-23 is free and clear, is at least public domain in India but it is not here.

And so we are talking about agreements with the three record companies to free up this historical material. I think the good news is they don't even want to store their masters. They don't want to invest -- they realize there is no money in these. So, there is an opening for conversation for archives to get licenses to stream pre-23 material at the very least. I mean I was successful with SONY, we were successful with SONY to do that for the National Jukebox and I think that conversation could certainly be extended to other marketplace orphan recordings that are never going to see commercial release.

So, I think there is hope in that regard, at least for the intellectual property but, nonetheless, it is something that has to be dealt with first before we talk about open free access to the content.

MR. NYE: A very important point that you have made. One ray of hope here, thinking about South Asia, and that is all I can really speak to is that the government of India's Copyright Act 1954, most people interpret as allowing access to these resources pre-1954 -- worst case, pre-1947, the year of independence.

So, we are hoping that by work through the government of India, that we will be able to get a full and legal rendering of interpretation of the Copyright Act that would open up access much more broadly and remove some of those constraints that would then permit the resources to be delivered from South Asia itself, if not from the states. From the states, I think we would still probably be prohibited by virtue of our obligations under the National Copyright Law.

Yes, but simultaneously, the kind of arrangements that you have been able to work out with SONY and ones that I am hoping we may have some possibility of working out with Saregama are the best way to go. It is the only way to go.

PARTICIPANT: Can I just ask if when you were talking about the project of creating some sort of a -- I don't know if it is a database or some sort of looking at the EMI catalogues and those materials, have you looked at the Charm Database? That is a big project that was done in the UK a few years ago and they did a database of all the EMI catalogues and they did include some that were not from around the world and it might be useful to you to look at that. I can talk to you more about that if you don't know about it.

MR. NYE: Well, the resources that were used for the Charm database are microfilm copies that the previous National Sound Archive had arranged to procure from EMI, itself. And in fact with changes in leadership at EMI, the current folks in charge, and that includes Wayne Shevlin and the

curator Joanna Hughes, were not aware that the British Library had this copy, the set of microfilms. But it is that same base the Charm Database was built off of but which did exclude the South Asia content is what we would like to build upon, yes.

I would like to raise a question about the sonic and well, the way in which you described in conclusion the new possibilities that are open for the Bell collection and interpreting the sonic world and all of the other artifactual materials that are associated with this. This is so terribly compelling to me, along with the fact that the historical linkage into pathology, audio pathology, was one of the chief motivations for Bell and, I guess, explains why it was the spoken word, rather than recorded music that fascinated him for the earliest of the recordings made.

MS. STEPHENS: We actually don't know the full extent of the content of the recordings. There may be more music. We have found one so far, one recording is music.

But yes, I think that in our pursuit of the origins of the industry, the present day industry, we live in a world -- when I give a tour of the exhibition, I start by saying, for our visitors, we live in a world saturated with recorded sound. And it is almost impossible to put ourselves in the mental state of a world where there was none. So, how did those people think about sound, speech, hearing, what could be recorded, what could be said, what could be played, at the time that they were working with it? And I think that is a big historical question to capture that atmosphere, that time.

And there are various studies of the process of invention and bringing innovations to market. And I think examples from that time are rich with opportunity for historians of technology, historians of science, people who are interested in performance. And I am certainly an interloper in all of this. I don't pretend to be -- you started your remarks by saying your background. I am a historian of science and technology but my research

interests are in the subject of time. And I tripped over this, this meaning the Volta collection, because I am responsible for it as a curator but I don't pretend to be a sound historian.

So, I am hoping that we have seen that there are media scholars, historians, who are hungry for this information that is in these recordings and that the appetite may, in fact, stimulate funding sources, if there is enough demand to bring it back to the question of where do the funds come from.

MR. NYE: Carl, I can't imagine that you first saw when you started work with IRENE, that there would be all of these historiographic and even ethnographic questions that would emerge just by virtue of sound that was previously impossible to play back now being audible and that can be associated with other documentary information.

DR. HABER: Not having come from a background in audio history, ethnography or any of these subjects, and coming into this as really a kind of naive outsider, I feel like every day I learn something new. So, it has been a revelation

personally but yes, I didn't foresee much of this.

PARTICIPANT: Okay, I have two questions for Dr. Nye. The first question --

MR. NYE: No Ph.D. Call me Master Jim.

(Laughter.)

PARTICIPANT: Fair enough. First question. Have you come across, in your trolling through the Sri Lankan archives, have you come across any material in Portuguese?

MR. NYE: Yes, but in fact there was a large amount of recording done in Goa. You probably know that Goa is --

PARTICIPANT: Yes.

MR. NYE: -- part of a big Lusophone belt going across that equator almost in the world. Yes, and because of the way they collected for Radio Ceylon, a large number of those recordings that were made in Goa, in Southern Portuguese, are in fact available in that collection.

PARTICIPANT: I was wondering more about songs or musics that had been generated, developed during the Portuguese period and that

wound up as part of Sri Lankan cultural inheritance.

MR. NYE: I don't know. I can't say. But it is very possible. Yes, I hadn't thought about it from that perspective. I guess I know it more from the side of Goa and India. But I am going to be there next -- I will be there in about two weeks. I'll ask some questions.

PARTICIPANT: Well, keep us posted.

The other question I have regards the EMI. This is just really idle curiosity. Who actually do you wind up dealing with in regard to at least the materials of historic significance? Because EMI is owned, a pop component is owned by Warner Brothers now and the rest of the company is owned by Universal. I am just wondering who do you go to?

I know that there were real questions about the survivability of Abbey Road, which seems to have been settled for a while. But who do you go to and who actually is responsible for maintaining the materials of historic significance?

MR. NYE: Well, it is fortunate that the trustees for the EMI archive, and that is separate from the corporate enterprise of EMI, are -- these are enlightened individuals, almost all of whom who have had some kind of historical connection with EMI and its good old days.

The person who, well you have met with, Wayne Shevlin, Carl, has had a leading role within the trust. He is somebody who started off as a rock musician in New York City and eventually went across the Atlantic and got himself a fine position at EMI. But he is the person who has really taken it under his wings to expose as much of the resources as is comfortably settled with the EMI corporate management, put those assets into public view.

So, there are some enlightened individuals, enlightened from my perspective, who see it in the best interest of understanding recorded heritage to have these things out and exposed. And there are a couple of other trustees who are of like strength with Wayne Shevlin.

PARTICIPANT: It is great to hear this

and also kind of shocking when you look at the kind of devolution of EMI in the last ten years and see that something with a more a long-term perspective has survived.

(Whereupon, the above-entitled matter went off the record at 11:57 a.m. and resumed at 1:35 p.m.)

MR. ALYEA: Okay, so this afternoon, our first talk is Fenella France from the Library of Congress. Take it away.

DR. FRANCE: Good afternoon and I just really just want to take a moment to thank the organizers of the conference and just the incredible presentations and the expertise. It is really wonderful, I take my hat off.

I am delighted to be able to have the opportunity to talk about some of the research we are doing in the Preservation Research and Testing Division here at the Library of Congress. And really a lot of that is stimulated by our interaction with colleagues out at Culpeper who are doing the hands on with the collections and seeing the hands

on issues with how they can actually capture content from various materials.

And so one of the challenges we have -- in the Preservation Directorate we have to make accessible all of the collections of the library even in their original or reformatted forms. So, the challenge we have with over 160 million objects, and one object might be a box of 600 papers, that really is a lot of information in terms of what the material challenges are for those materials. And because we are a library, of course, we have the conflicting challenges of the use of the material because people want to use it, the environment that it is stored and the inherent material properties. And that is really what I will be focusing on a lot.

I was delighted to hear Jim this morning talk and focus on the importance of collaborations because a lot of the research we do, we have a limited staff, is working with academia, working with our colleagues, working with other folks around the world and within the States to actually try and move forward this research. And I hope you will see from

some of the examples I give how we try to approach that.

One of the focuses, as Carlene pointed out this morning, is we really like to, as much as possible, do noninvasive testing. And while some of the testing we do is destructive, which we need to do to understand the degradation mechanisms, the main focus is actually doing noninvasive. And I do want to just take a moment to note Sandy Pearlman, who has been one of our wonderful contributors to a collection we call CLASS, the Center for Library Analytical Scientific Samples, which allows us to do testing on non-collection items and Sandy has been an incredible support for that. Thank you for that, Sandy.

Accelerated aging is one of the things we do to look at predictive testing. So, what we are really looking at is trying to see how can we predict what is going to happen down the road with materials. And of course, that is one thing that we want to know. There were discussions this morning about what are the priorities, which

materials should we transfer first before something happens to them and that is a lot of what we are really trying to do to get ahead of the game in terms of what is going to happen with that content before we lost that content.

We have also done a lot of correlation studies between natural and accelerated aging. One of the challenges I feel has been in the past that people used very high heat, very extensive over-the-top accelerated aging, which really didn't reflect what was happening in normal environmental conditions. And so we have modified that somewhat to try and reflect what we really are seeing happening in the normal environment collections.

Quality assurance testing also came up. I have to thank my colleagues for setting up all these components already, because anything that comes into contact with our collections can potentially cause harm. And you will see in some of the testing we have done and the specifications which develop what should be in the contract to

actual to purchase those materials is a large part of the research we do and, I think, incredibly important and probably doesn't get the focus that it should. And those specifications are online at the Library of Congress website and we are constantly revising and updating them.

So, jumping into some of the various forms of research; firstly, degradation of magnetic tape. This is a scanning electron micrograph image of a piece of tape. There you can see the polyester Mylar underlay and then the magnetic component on top. The challenge is that top layer degrades, and we are losing the content from it.

I was talking in London two days ago and I used the term “sticky shed” and everyone kind of grinned. They laughed. They thought it was funny. It is like no, it is a real term.

As you know, this sticky shed syndrome is a huge challenge and once it goes across the heads of the player and sticks to that, because of the volume of material that our colleagues out at Culpeper are trying to transfer before we lose that

content, the cleaning of the tape player means they can lose an entire production day and really is a huge issue.

So, from discussions we have had with colleagues at Culpeper, we were trying to look at what could we do in terms of a collection care tool, something that would help people understand before they put that tape onto the player and actually know whether or not it was sticky or not. And of course, there is a lot of expertise in knowing that already but there are a lot of challenges if it doesn't happen until you are part way into the tape. So, this was part of what can we do to kind of develop a tool that would help us understand that better.

And again, going with the non-invasive, using attenuated total reflectance Fourier transform infrared spectrometry, really just think of infrared spectrometry, we were looking at how could we actually just take a spectra of the surface of the tape and look at where were the peaks that were telling us what were the changes that were happening in those materials.

And the challenge with it was, you will see on the left, that there were certain peaks that we seemed to see coming up time and time again as the tape was degrading. But because all of the materials and the tapes were often in different states of degradation, it wasn't always exactly the same. And trying to kind of visibly do that by eye was almost impossible, in terms of the volume of information that you were gathering.

And so we then went to essentially a chemometrics model, saying how can we actually use statistics to pull out this information and extract and get a good feel for what is happening.

So, by doing that, we could take this to an LDA classification and quite clearly separate the sticky from the nonsticky. And this has really been incredibly helpful and useful. We have found it about 98 percent -- it's Friday afternoon and I've lost the word I am looking for -- 98 percent accuracy for this test.

What we have also been looking at, we started with quarter-inch tape and have been

expanding this to pneumatics and we are looking at other tape formulations as well. We have also looked at other collections at NPR, University of Maryland, just to make sure the dataset is not only applicable to the Library of Congress collections. And part of this is also a collaboration with the University of South Carolina. We have been developing a tool literally that you would take into the collections. You would take a tape, take a spectra off that tape, drop the spectra into the database and very instantly be able to say is it sticky or is it not. So, we hope to have this database and tool either hosted on the Library of Congress website or at the University of South Carolina within the next year. So, that really has been a very successful collaboration and helped us move forward work that we have been doing here in terms of the material degradation for about the last four or five years.

Just taking it a little bit further, and you all, as experts, know this already, really what we were finding is that from the '70s to the '90s

polyurethane, polyester-urethane was the main binder. There are a number of others. There were certain tape formulations that were more problematic, but we are really starting to tease out what was happening at the ester linkage, in terms of the chemical breakdown of this and then also, we were starting to promulgate the metrics that allowed us to pull out what types of components can we use to differentiate the deterioration that we are seeing between different tape types.

Starting with magnetic tape here, one of the next challenges, of course, is if it is sticky, how do we play it and the whole question of baking. I am not a sound engineer, so I step back. As a scientist I am just presenting this information. But of course, this is an image of the tape before baking. You can see the raised areas on the surface and then after baking, when the exudate dries and it allows you to do the capture from the tape after the baking.

There is the new ongoing and very interesting and often spirited discussion with our

colleagues out at Culpeper about the fidelity change with baking. Is there a fidelity change? How do you measure it? How do we get an objective measure of this?

And so we had master students from the Cultural Heritage Information Management Program at Catholic University who did their research practicum with us. This is a new initiative at CUA. And we had one student who worked on looking at the tape fidelity issue. The initial challenge was trying to create, and I have to say, Peter was incredibly integral to this project in developing the actual tones and software to actually play those, put them onto some of our reference tapes and then get a good measure of them.

And Peter, you haven't even seen this yet but I just last week did get a scatter plot when we actually started to look at the data and, for the first time, we could definitively from this objective measure, show a difference between baking, prebaking and baking and then also between first and second bake.

So, this is clearly a project that is still in process but we are really excited because when you look at the box chart, you can very clearly see a differentiation between pre and post bake measurements.

So, this again, with our interns and some of our research projects, helps us start to move forward this work that we are working on.

And then taking this a little bit further, it is just a really nice tripartite component in terms of magnetic tape. I was at a conference where there were folks from Fujifilm and, initially, I was interested in talking with them because I wanted to know what the current composition of storage media we were using and how do we know that when we are transferring something that it actually doesn't have to be migrated so many times. And then we started talking about their accelerated aging facilities. And my question to them was, whether it would be possible for us to try and recreate sticky shed from our reference tapes, using their facilities. And they were very, very

interested in doing it. They were a little bemused why I would want to do that until I explained that we don't know what is actually causing it in the first place because we haven't been able to recreate it.

So, we have developed an MOU with the folks there and we sent them a number of our reference tapes and came up with a plan to actually look at the chemical, physical and the magnetic properties from the tape.

So, they have now analyzed with all of these different components the reference tapes as a baseline of what we gave them and we are going to age them in various conditions in a range of different ways.

What we have found so far is in terms of the lubricants, these three kinds: lauric acid, myristic acid, the third one is unknown but research is still underway in terms of those. We know the molecular weight and we can still track any changes in there, based on what we already know.

As I said, we have quantified the unaged

properties of these and we will now move forward with the next set of testing. And so what we are doing is we have set up a number of different humidities. We do have some high humidities in here, in terms of our colleagues from high humidity environments, but really just to see what is happening, how we are seeing the properties of these materials change, and can we, from this, actually induce the type of damage that we are seeing in the tapes in our collection. So, this is how we are moving forward with the third component of the magnetic tape research.

Another question that came to us was looking at film cans, in terms of the chemical and physical degradation. And essentially, there was a residue that was appearing on the outside of the cans. We were concerned whether that was a health hazard for the folks out there. And then there was also a propensity for the cans to actually to scratch as well.

So, we started looking at the residue on the film cans here and analyzing them. We did determine there were no VOCs. We wanted to ensure

that that was the case. And we saw a range of hydrocarbons, generally, with that.

But this actually was part of research that we did into the development of the specification for what they should be using. Because historically, there had to be a flame retardant in these cans, the concern was that these were causing damage to the films, themselves.

So, we looked at the old and the new cans. I will, at this point, pause and apologize. I am not allowed to actually refer to the specific company. So this is why you see Can A, B, C listed on these slides.

So, in terms of the old cans, what I am calling Can A, we actually did find bromine in those but only the old cans. The new cans did not have this. So, that was a good component.

And then Can B (old) actually had both bromine and antimony in those but the new cans did not. So, this was good, as we moved forward with the specifications and actually looked at which types of cans and which cans in the collections may

need to be replaced and should be looked at going forward.

The only challenge, as I mentioned, was the fact that we were seeing some deposits on the surface of the films after they had been transferred to Culpeper. And the question was, could we then do a scratch test on the film cans, themselves, to see which cans were more likely to have this deposit scraped off them.

So, part of this was actually developing a scratch test. We didn't really have one that would work for these materials. But you can see there Can A, B, and C, where Can A on the left actually has a lot more deposit from the scratch test that we did. And so this helped us, actually, in the part of the testing when the test materials came in for the contract actually helped us determine which would be the best can that would be safest for the collections.

So from that, as we see, the oily material -- I'm sorry that slide that keeps closing itself down. The oily materials were primarily

hydrocarbons. The XRF determined the materials we are finding from the flame retardant. We did confirm that with the GC/MS and then we did see where from all of them, that a significantly less from some than others.

We also had a question a couple of years about what sort of cleaning materials or cleaning methods would be best for things like lacquer discs. And one of the questions was what was the exudate that was forming on those and how could we remove that safely? There were a number of ways that people were doing that.

So, essentially, generally what we found was a combination of palmitic and stearic acid, as the exudate itself. And then we wanted to look at that in terms of how we could easily remove that.

Again, my second apology here. I have removed the name of the manufacturer but I can give you the composition components, which would help you determine what might be a useful solution.

So, we were looking at a number of

different ones, different cleaning solutions and we also had a very good discussion with our colleagues at Culpeper about the way they actually cleaned these, whether they are using the Monk machine and how many rinses they used, things like that that actually factored into what we actually did with this research to make sure that it was actually valid to how it was being used in terms of the collection.

And so we found that both solutions were soluble in excess water. Some, once they had dried, were more difficult to remove from the surface because we wanted to make sure we weren't leaving any deposit on the surface of the discs itself.

And when we exposed the disc to cleaning solutions, essentially found that the non-ionic surfactant and the ammonia was actually the best combination, which as many of you already know that. But I really wanted to make sure that what we had on the surface was being removed effectively.

CDs, some of you who came on the tour yesterday -- Wednesday, apologize, you probably heard a little bit of this already. But CDs and DVDs

is actually another big area of research that we have been looking at. These form a large part of our collections. We still have collections that are coming into the library on these materials. For example, we have things coming into manuscripts when someone retires from Congress and we have every type of storage media you could think of, going back to 3 and a half inch floppy discs. And so the question was with the CDs, how do we move forward with understanding why they are degrading.

So, here is an example of why we do some testing, and why accelerated aging. This was a long-term study we did with NIST where we actually had a large collection of CD-ROMs, CD-read writes, and DVDs and looked at comparing both the accelerated aging and the natural aging. We have just completed a 15-year repeat of the natural aging and we have seen, generally, about a four percent loss but the ones that are coming in a worse condition at the beginning are the ones that are clearly degrading faster but not actually quite as dire as a lot of people think.

But in terms of the composition, one of the challenges, of course, with these model materials is that manufacturers were not making with preservation in mind. They weren't making them to last a long period of time and they were also trying to get them out to market fast. So, what happened with these early compositions is the formulations could have changed quite quickly and that is what we are trying to understand in terms of which of those formulations are the ones that are more at risk.

And so turning to the polycarbonate, here you can see the disc after the aging. The image on the right shows the areas that really showing complete damage and this disc would no longer be readable.

But then also the challenge is well in tune to the reflective layer. One of the challenges -- there are a lot of components of this but I don't want to keep talking too long, but one of the early things we looked at was the fact that the moment you actually put a label onto a CD, you start that

degradation process happening. And that was one of the things a lot of people didn't realize that just by doing so you just completely changed the preservation of the disc itself. But we really have been trying to sort out in terms of the components what all the different issues we see in terms of the rot, CD rot and things with the different layers and understanding the degradation of those components more.

And this is an interesting example. As I said, we do a lot of accelerated aging. Initially, these two CDs we thought were exactly the same. After the accelerated aging, the one on the left is actually perfectly fine; the one on the right basically lost all of its information. So, this is part of the work that we are doing to better understand how to make predictive suggestions about what parts of the collection are more at risk than others.

Wax cylinders was a more recent one where we were sort of asked to look at how we could actually remove some cotton batting that had been embedded

into the surface of some wax cylinders. And this was really just trying to see how you might be able to remove this with some very gentle extraction from the surface. And so some of what you have seen here is just the image there, we are literally just rolling a swab over the surface, not really even contacting, just to try and lift those items that had become embedded in there.

And you can see here, I am not going to talk about the groove structure because we have our expert talking next. Bill is going to talk about the grooves. But you can see here how they are more rounded. They are also, we can still see that fiber component embedded in there and that is why something like this makes it a very good candidate for capture with IRENE, where we are really not touching the surface and pushing those fibers further into the wax.

Another example here from a different area. You can see the post-dry clean on the right and the post-wet clean. And then again, you can see as we go to the 60 time magnification, still the

structure of the embedded fibers on the surface there.

One more example here. This was one that was stored without the cotton wrapping and you can see how it is an awful lot clean. We are just not seeing it damaged.

So, these are very practical examples of how we really need to engage in terms of how the science supports the preservation of the collection and the capture of this incredible information in these sound recordings that you have been hearing from us.

Based on some of the discussions this morning, I wanted to drop in a couple more slides here of something that I hope we can discuss a bit more later. One thing I have been looking at is the development of an integrated heritage science infrastructure. And we have a bilateral agreement with colleagues in Italy. We are really trying to look at a global infrastructure for how you share and make data accessible. I am going to completely dodge the copyright question here by doing this but

we are looking at this for research data and it seems to me that this could be a useful model moving forward with all the types of data and how we could link some of the very interesting and rich artifact sources that so many of you have mentioned that link with us with the sound recordings, for example.

And so we have actually developed a schema. We have put all of our reference materials into the system and we hope that will be online within the next six months.

But the next part of that which really comes back to more the how do we understand and interpret these materials is kind of user interface. As we all work so interactively with data these days and we all want to build a kind of linked data. I was watching a baby on the plane. It instantly knew to touch the screen to make things happen. It is quite fascinating. But what we are really looking at is saying what overlays all this data that is underneath and how do you link it altogether? And so this kind of object oriented approach, when you have an object, an image of your object, where there

is a sound recording that you click on, and then you start to link all that together, all of the various components.

So, here is just one of a document, it happens to be a first draft of the Gettysburg Address, but if you think about this as a Google Map of your object, and as you click on this, you can bring up some of the microscopy. You can bring up some of the handwriting analysis and the interpretation. You can bring up the spectra of the ink. You can bring up some of the fiber analysis itself. You can bring up the fingerprint that we found but that is a whole different story.

So, just in summary, I really wanted to underline that really understanding the material degradation helps us support all of the capture and the work that you all are doing to make sure that these collections are still there as we go forward. The impact of the environment and handling is clearly an important component of that and the cleaning protocols and the stabilization helps support the preservation as well.

The quality assurance in terms of the materials collections are in contact with, is quite a critical component as well and the specifications that underlie that.

And I do want to note that most of our research reports, we try to keep them updated, are actually on our website. I am happy to give you that link later but I just wanted to let you know that all those research reports are available there.

So, thank you for your attention.

MR. ALYEA: Now, we have Bill Klinger to talk about grooves.

MR. KLINGER: Thanks, Peter. Hello, everybody. I am Bill Klinger. I am an engineer and a record collector. Today, I am going to talk about In the Trenches: Surveying the Groove.

The original version of this slideshow was presented at the 2005 Conference of the Association for Recorded Sound Collections. That is ARSC. In ARSC, I have been in the technical committee and on the -- that is actually the chair, the Cylinder Subcommittee since 1993. So,

cylinders are my passion.

My colleague, who put this talk together with me, George Brock-Nannestad, resides near Copenhagen, Denmark. He is a mechanical engineer and an electrical engineer and also a European patent attorney. He has educated people throughout Europe for many years about sound recording and preservation.

I think when these Germans in this trench were here, the last thing on their mind is how much their trench looks like a lateral-cut groove. George found that picture. He also put together this silly picture, posing us as surveyors. This is a trench at Vicksburg, the Civil War battlefield, where there are 20 miles of trenches that do resemble a 78 groove, pretty much.

But George wanted me to remind everybody that it is important to study the groove and then respect the geometry.

Everybody is seeing this kind scanning electron microscope photo and it shows this very sharp V-shaped groove. It is the standard groove

for stereo LP records cut with the Westrex 45-45 Recording Systems but it has almost no relationship to cylinder records and not a whole lot to a 78 shellac record, either. This idea of a pointy needle sticking in some kind of a V-shaped groove is very deceptive when it comes to cylinders and discs.

People have been interested in the profile, the shape of grooves for a very long time. This photo was taken by an amateur photographer in 1900, after he cross-sectioned a 78 -- at that time, it wasn't probably 78 rpm but it was an early disc record, lateral-cut. And you can see these little U-shaped bits that represent each line, each rotation of the groove. So, if that is a lateral-cut disc record, what is this? Who can guess what this is?

David, you can be quiet because you know. Thank you, Jerry. Gold star for Jerry Fabris. This is the surface of a cylinder. You can barely see the groove. The grooves are so shallow, they are so foreign to us compared to what we usually think

of.

Let's look at a couple of basic concepts and mechanical sound carriers. George made these sketches back in 1983 just to show people who aren't familiar with records about the vertical-cut motion on a cylinder versus the side to side lateral motion but you have heard that a number of times over the last few days. There is a couple of methods for forming that groove but one of the earliest is in Boston. Carl Haber talked about that. That is merely displacing the material. You are not removing anything from the material. Cutting is much more common. It is also called incising or engraving, definitely removal of material.

On the left, this drawing shows a very rounded stylus deforming the record in the embossing process. That is the two images above the letter A. And on the right, you see a much sharper stylus that is cutting away material at the top and then you can see it riding in the groove on the bottom on playback. So, generally, embossing involved rounded, not very sharp styli.

Thomas Edison's 1877 phonograph, of course, used tin foil. Actually, that sheet is a composite of lead and tin but it is just generally called tin foil. Jerry Fabris took this picture for me, showing the modulation. You can see the little bumps, the indentations that represent the audio content. It has just been a deformation in that metal sheet. Surprisingly, embossing went on and had a life in deforming plastics. These are both dictation media, a disc and a belt, used as late as 1980.

Cutting in wax probably reached its peak in the late 1940s. This guy, John G. Frayne, who wrote *Elements of Sound Recording* was one of the people who optimized this kind of cutting stylus for electrical recording on 78 records but the very sharp edges on this stylus are typical of what has been going on with cutting and soft materials since about 1888.

When you playback something, people talk about tracking and tracing. You probably hear those terms all the time. What the heck is the

difference between tracking and tracing?

Tracking is the process of following the path of the groove. It has not really got anything to do with getting the sound off. It is just the starting point for following the groove. That is something that Carl and Earl have really figured out how to do with imaging. Tracing is following and reading the modulation on the recorded groove of a phonograph record.

The tracing action following the motion, in mechanical terms, a mechanical engineer would say it is like a cam-follower action. George pulled this drawing out of a 1920 textbook on mechanical engineering but it is not very graphic. Later on, George got his son to make a little animation that just shows how a roller would follow up and down that kind of surface. So, it is an analog to what you have in a vertical-cut record like a cylinder.

Similarly, the lateral-cut motion rather exaggerated in this animation, is the left and right motion. Trying to track the groove and

then trace these things accurately can really be a challenge, especially at higher frequencies.

Let's talk about the shapes of vertical-cut grooves and look at some historical recording equipment. Edison was busy with electrical lighting by contract for a decade. During that time, the Volta Lab guys made a lot of progress doing all these wild experiments with light and photocells and cutting in wax and all kinds of materials. But when Edison returned to phonograph development ten years after tin foil, in the fall of 1887, his assistant, let me think, what is his name, built his machine. Edison didn't actually -- it was Ezra Gilliland who built this machine. He was an electrical tinkerer, basically.

These were the first machines with electric motors, regulated speed, and the important thing is, they were the first to use a solid wax cylinder. All three of these machines took a rather soft wax record, mostly natural waxes. Collectors have called these white wax cylinders for a long time but Jerry and I think that that term arose because

people typically saw black and white photos in which they look like they are white. Edison, himself, called them yellow paraffin cylinders. They are quite soft. These records made in 1888 are truly the incunabula of recorded sound. These are the first recordings meant to be played back. And just a few dozen of these survive today.

They were such a landmark development that probably around 1906, Edison and perhaps Walter Miller, his recording engineer, placed three recordings from 1888 and 1889, together with the transducers that cut them and played them back. The metal objects, one is a recorder and one is a reproducer, they enshrined them in this oak and glass case. Jerry tells me the base was made from an Edison standard phonograph base. And this sat in Edison's library. It is shown there in a photo in 1947.

Jerry took these pictures of the recorder. That is an interesting piece with the diaphragm suspended in a brass housing. The important to note here in this photo is the cutting

stylus. This is a side view of a very sharp steel chisel. That is what cut the record. The groove looks something like this. This is taken from Edison's patent for this kind of recording with the chisel-shaped cutting stylus and it makes a rather squarish looking groove. The bottom is almost entirely flat.

Edison's yellow paraffin records, like I just mentioned, have this distinctive chisel cut. They were only made for about one year. Precious few of these things survive today.

Edison recognized early on he had trouble playing this thing back because he used a piece of wire sharpened at the tip like this, that is Item N in this patent drawing, and he made it smaller than the groove but he had a great deal of difficulty tracking and then tracing this because the playback stylus would wander from right to left across this groove in an uncontrolled way. Every time it would touch the left or right groove wall, all you got was noise because all the information content is in the bottom of the groove, the

horizontal part, rising up and down. Edison recognized this late in 1888 and sought a solution to this. He sought a whole new profile for this groove that would be almost foolproof and it would align the playback stylus automatically.

He developed this circular cutting stylus made of steel. At letter B on the left is a scooped out area. It is basically a rod of steel that has been ground out at the end to make an exquisitely sharp cutting edge. So, at this surface is a very sharp edge and another one at the bottom. The entire round surface makes a circular cutter. It was mounted in this kind of recording device. You can see it is cutting the surface of the cylinder here.

This very graphically shows how it scoops out the material. That circular cutter digs out this kind of cross-section in the vertical-cut groove.

I think this is a good picture to keep in mind. It actually exaggerates the depth of the groove. The groove is more shallow. The shadowing

in this photograph makes the groove look deeper than it is.

Edison used steel cutters and playback styli for only about six months. He found that the steel was corroding. Apparently, there were acids in the yellow paraffin materials. And around the same time that he developed the circular cutter, he changed to a somewhat harder material that collectors call brown wax. It is a metallic soap composition. The ideas came from the soap industry but it is a much harder material than waxy bars of soap.

And interesting thing about this particular assembly, which has a cutting stylus and a playback stylus both made of sapphire is that these were precision ground sapphire styli in 1889. So, as early as that, Edison established the dimensions of the grooved profile to a very high degree of refinement. You can see that the playback stylus is basically a ball but it has nearly the same diameter that the cutting stylus does. It was used in this machine beginning in 1890, cutting this kind

of brown wax cylinder. That is an early box that was only used for a few years early in the '90s.

This is a really important drawing. It comes from a court case in which Edison had to explain the contact between the stylus and the groove. And you can see the shallow groove receives the arc of this playback stylus almost perfectly. The entire arc is contacted. At least that is the intent. Of course, on a microscopic scale, it is not touching everything. There are irregularities in the surface.

Another thing to note is that this groove is so shallow, it is 17 times wider than it is deep. So, it is really impossible to talk about groove walls on something like this. It is very, very shallow. There is no left and right wall. It is just a tiny, little shallow groove.

And this sapphire ball was used all throughout the 1890s. It was copied by his competitors, the Columbia phonograph company. Eventually, Pathé and France were all using the same thing. So, in the cylinder industry, the

dimensions of the groove were standardized early on within the first few years and everybody was using the same kind of precision-ground sapphire styli.

I'm going to talk in terms of mils. That was the approach to referring to one-thousandth of an inch in the U.S. and Great Britain. And since a lot of these documents are in mils, I thought I should explain that. But that is the equivalent of 25.4 micrometers or microns.

Here is another view of the sapphire ball used to play brown wax records with that 35 mil diameter. But an interesting thing is, at high frequencies, the fine features of the groove are too fine to be traced by this large stylus radius. If you have a standard sized cylinder recorded at 120 rpm, this 17.5 mil radius creates intolerable distortion at any frequency above 1500 hertz. So, it is a rather low cutoff.

Edison recognized that and wanted to do something about it. He was getting competition from Columbia, who had made a large diameter record that didn't suffer this same problem. He created

a different kind of playback stylus. It retained the same 35 mil diameter across the groove but he put another radius on this stylus that is 7.5 mils radius, 15 mil diameter. This traces the groove. So, you can see the change. The weight of the stylus is still supported across the entire width of the groove but the much smaller radius allows higher frequencies to be traced. I don't recall exactly but I think you can get to five or six kilohertz with this kind of size at a typical brown wax speed.

But this stylus was actually designed for harder molded records. That is another reason he went to a very shallow groove. I will talk about that more in a minute but these harder wax cylinders from Edison and Columbia and later celluloid-based cylinders all used that standardized groove profile.

Between 1905 and 1908, there was a big competition forming because disc records were getting larger. They grew from seven to ten to twelve inches. The ten-inch disc was lasting three minutes, whereas, most standard sized cylinders

lasted only two. And as a result of that competition, Edison decided to make a more compact groove configuration, putting 200 grooves per inch. Actually, one groove on the record, 200 turns per inch, instead of the 100 previously.

So, this compares the smaller size of the new four-minute stylus. Edison's wax four-minute record, a competitor with celluloid, and then Edison, eventually, in 1912, was able to use celluloid for that kind of four-minute cylinder.

We talked about shaped. Let's look at some dimensions. For years and years, it was hard for me, anyway, to find out what were the actual dimensions. We could see patent drawings that showed what these styli looked like, their shapes but it wasn't until I found this 1919 court case. The Victor Talking Machine Company was suing the Starr Piano Company. They made shellac discs under the Gennett trade name. And beginning with the yellow paraffin record of 1888, for this court case, Edison's attorney, Frank L. Dyer had all these drawings made up. This was the first time I have

ever seen any exact dimensions of the chisel stylus that cut the yellow paraffin cylinders and it cut a very deep groove. Five mils is a lot deeper than the later circular groove.

The reason Edison wanted to get away from this very deep groove is because he wanted to make duplicate records by molding. They would make a master cylinder, plate it with metal, keep plating it until you had a mold and then wax would be poured into that metal mold. As the wax cooled down, it would shrink and could be extracted from the mold. But with this groove being this deep, you couldn't get the cylinder, the duplicate cylinder out of the mold. So, it is interesting to see this transition from the very deep groove.

But notice that with an average depth of five mils, the modulation from maximum to minimum, in other words, the maximum depth of cut is just another half of that. It is another ten percent of the basic original dimension. So, you are adding half a mil or subtracting half a mil from that groove depth.

I mentioned before the Volta Lab, when they developed the graphophone in the 1880s, they had a wax-coated cylinder that people today call a Bell-Tainter cylinder, they called it the graphophone cylinder, that also had a rather large stylus which made a ten-mil deep groove initially but, in a later development, they decided to go shallower. That was the trend in this technology.

So, a second patent shows a five-mil depth but again, there is only about a plus or minus ten percent variation. That is not much dynamic range from the quietest to the loudest passage, it is nothing like modern electrical recording, where you can have 80-90 dB of dynamic range. There was really only about a two to one variation in the depths of these grooves.

So, the brown wax cylinders with circular grooves, I am going back and showing you this picture again of that cupped stylus because this shallow groove sets a whole new trend. The average groove depth now is only 0.55 mils but there is still that same plus or minus ten percent

variation. So, still, it is about the same kind of dynamic range. But with a harder material, the tracking force could be higher and more volume could come from the horn.

This is a groove profile of a Pathé Disque record and it is very much like a cylinder. When Pathé first began to make disc records, they used the same cutting stylus and the same playback stylus that they had used for cylinders. That is why people who try to play these Pathé discs, these vertical-cut Pathés on a turntable, find them almost impossible to track because the skating forces and the anti-skating mechanism on a modern turntable just wants to slide that tone arm right across the groove.

Edison later used the same kind of thinking to make diamond discs but it had a deeper groove because he didn't have to remove the diamond disc record from a mold. But again, you see the relationship of the stylus tip for playback. Edison wanted a very, very close fit. He never wanted a little tiny stylus to be tracing these

records. He wanted to spread the pressure across the entire width of the groove.

A lot of things can go wrong in recording. This is a very good example. The groove is discontinuous here. You can see little pits but there are places where the cutter has lifted away from the surface and you are not even cutting a groove anymore. This is seen a lot in amateur recordings and field recordings. Most commercial records made by Edison and Columbia and the other 432 manufacturers of records around the world had very standardized grooves. But people with ethnographic collections, I think, are going to encounter this kind of stuff. It is a flaw in the recording. It could be caused because the material was too cold. Different things like that can cause it.

Shifting over to lateral-cut grooves, this is the Berliner-Johnson. So, Emile Berliner's recording machine around 1896. Again, thanks to Frank Dyer and the court case, we can see the dimensions. Rather deep grooves because they have

to propel the mass of this horn. The horn and the tone arm is propelled across the disc by the depth of the groove. So, really, gramophone discs really never could have very shallow grooves because they didn't have the feed screw that was in all these Edison phonographs.

I am just going to blow through some of these images but we have documented a number of the stylus shapes and sizes from these original records.

I talked before about how Edison standardized on groove dimensions and profiles, cut precision-ground styli and the whole industry followed him on that kind of accurate precision technology. But Emile Berliner and Johnson, after him, just went down to the millinery store and bought a number five sewing needle. That was their recording stylus. And even after 1911, in this court case, William Nafey, who was one of the people who eventually made jewels for Victor said well, we didn't buy the sewing needles anymore after 1911. We made them from steel wire that we bought. But Victor didn't have controlled groove profiles

either in recording or playback.

The whole disc industry, by and large, didn't have a V-shaped groove until the late '30s. All of these records have the same kind of U-shape. Franz Lechleitner at the Phonogram Archive in Vienna did all this work back in the '80s, trying to document all this stuff about groove profiles.

And you can see again, just a comparison of these profiles but the variation is tremendous. From brand to brand and time to time with disc records, you almost never can know what the profile and the dimensions are. And that is why transfer engineers are always having to try another stylus every time. People can look under a microscope, maybe, and get a clue at first but it is a challenge.

There is a lot of problems in cutting lateral-cut grooves. In 1952, Oliver Reed displayed eight different things that go wrong in cutting in a groove. I won't bore you with the details.

George thought it would be a good idea to blow up the groove and show you a little CAD image

that indicates what kind of problems can arise.

At a lower frequency, like 665 hertz, a groove can have a very wide left to right excursion. This one happens to have a 50-micron depth and be about 100 microns wide. And it is uniform all along its length.

If you go to ten times higher frequency, you are likely to have one-tenth the amplitude but you may still have the same depth and width, if you are using the same cutter. And you can still trace this kind of groove. It is a bit of a challenge. You can see that a stylus is going to have to be jumping around a lot. There is going to be a lot acceleration on that stylus tip in this kind of high-frequency groove cut at a high modulation.

But still, the groove remains uniform along its length. If that cutter is not perfectly parallel to the tangent of the record, if this cutting stylus is twisted a slight amount, all kinds of things go wrong. If it is shifted by ten degrees, for example, as on the right, everything changes about the groove. It is no longer of uniform width

along its path. It begins to pinch the stylus and tremendous distortions can happen.

And there are quite a few records where this kind of thing went wrong, even in the electrical era. That varying groove profile makes it hard to trace that groove and in this case, it is virtually untraceable, according to George. So, another example of things that go wrong.

But this kind of stuff was well-recognized. In 1963, Benjamin Bauer did a study of the fact that you may apply a nice sinewave down here at the bottom but what you actually get on the record can be quite different, aside from the fact that it is electrically cut and there is a differential kind of relationship to this. But the cutting stylus doesn't move in the same plane as the playback stylus and that is what this complicated drawing is trying to show. Even at the time records are cut, they may not have the ideal groove that you think that they do.

So, I think that that is a useful thing, whether you are trying to play a record with a stylus

or especially for imaging because when there is a groove that is kind of predistorted, you have got a challenge.

The steel needles that were sold for use with gramophone records, lateral-cut shellac discs, again, were not precision-made pieces of manufacture. They had very loose, rough dimensions and it didn't matter because about 70 or 80 percent of a shellac disc is limestone dust and it is an abrasive. It was purposely designed that way to grind down the steel needle. In the first revolution or two, the tip of that steel needle is ground away and it fits the record. After one minute, you have got a very good fit, a perfectly round contact area between the steel needle and the groove. But as the record continues playing, the needle keeps grinding away. And after three minutes, it has gotten to this very weird elliptical shape. You can still play the record but if you take that needle out and it gets rotated, if you try to use it again, you are really going to destroy the record. And this is one reason why people back in

1910 and 1900 knew to change the needle with every play of a record. People today have forgotten that.

The Victor Company and their counterpart, EMI in England made needles that they wanted to last a lot longer. I think they claim here it can last 150 plays and they did it by embedding a tungsten wire. In the center of this is a piece of tungsten and it is surrounded by brass or some other soft metal. And the soft metal still gets ground away down here but the tungsten wire supports this and it slows the wearing away of the material.

But the reason I am showing this here is not to talk about the tungsten needle. This is a mechanical model that EMI made in England. It is a series of steel laminations, stacked up, clamped together that allowed them to make visual models of the shape of a stylus and its relationship to a groove. So, even in the last '20s and '30s, people were seriously thinking about modeling the groove. They really wanted to understand all this.

George points out that this had the wrong caption when it was printed. They said it is a new

needle but it is actually heavily worn. And you can see what has happened here. Now, the needle is far wider at the top and it is pretty soon not going to make contact with the groove. It is going to lose contact.

So, we have got these modern options: stylus-based playback, non-contact. I'm not a champion of either. There is a place for both. They both of their limitations. They both have compromises. You can do your best to build a machine, to play cylinders of all types but there are still tremendous compromises and tradeoffs with the stylus, the magnetic cartridge, the tone arm. And I don't think anyone has that figured out to the Nth degree. Frankly, I think people all round the world are using styli that are too small and the wrong shape to play cylinders every day and I think they are doing significant damage and wear, playing a soft wax record. Probably not an issue for celluloid, maybe not so bad for a hard wax gold-molded record but for brown wax, this is risky business.

And I think that imaging has everything going for it because it has got a wide-open future. The stylus has gone as far as it can go. It is nothing but compromises. And I think there are so many possibilities with non-contact playback, the future is there. And George says respect the geometry.

Thank you.

MR. ALYEA: Good afternoon. People probably already known I am Peter Alyea with the Library of Congress, Digital Conversion Specialist, and I have been working on IRENE for 12 years with Carl and Earl and all the rest of the Library of Congress.

So, I wanted to talk about standards in terms of how to deal with the imaging systems, both the ones that I am working on the other kinds of designs that we have seen like visual audio.

This is not to say that comparisons to the standards in the audio field for traditional equipment don't need to be looked at further and things like that but what I want to do is I want to

look at how to build standards for our imaging system.

So, there is a certain baseline amount of quantifiability in what we are doing. One of the big advantages of the equipment we have been working on is that in the imaging world, it can be easier to quantify things. So, I wanted to go through some of the things that have naturally happened our development, and how that has helped towards building standards, and then look at some of the things that have fallen through the cracks, and then decide how to maybe rectify some of those things.

So, one of the big advantages of our system is in the hardware sense. The hardware we use is basically scientific equipment. These are scientific motors. They are called stages. They are specified and measurable. We have these probes we use to take the pictures. They are scientific-grade probes. We have lighting systems that are scientific lighting systems. All these things come from the world of science for measurement. So, they not only are they specified

to perform a certain ability, but you can actually take the measurements and confirm that is exactly what you are getting. And in fact, as these devices have been designed, this has been natural with Earl and Carl, to actually not just assume that the specifications they are told by the manufacturer what they are, but they actually perform experiments and they take data and they confirm that it is able to say take a picture of certain resolution or whatever.

So, as these things have been built, in that sense, we are very standardized because we know how these perform and the equipment is reliable in that sense.

If we move on to software, in some sense people might think of standardizing software as working only in a certain kind of code that is open source or not open source but open platform and things like that, so that there was always for any operating system you might encounter, you could always compile to that operating system.

We haven't necessarily done that.

Building code is very time-consuming and costly. And so the code bases we have, the imaging system capture code is written in something called Labview. And the code we have that processes the images is in what is called C Sharp.

Both of these, however, have source code. And because of the funding for these, that source code is not encumbered by licenses. It is basically the source code to be distributed. And that describes how this stuff works.

There has been interest, and I think we have heard from not only audience members but speakers, that there is a lot of interest in how we deal with that long-term. So, there is a great advantage that we have that this code we have is open and available. Some of the ideas of making an application that could travel with images to the person who has the images being taken for them, that that code could go there and that person could then process them themselves. So, this idea of being locked away from the most prime source of data-taking with the imaging, is not far away from

you.

And the application is quite small in compared to the documents. There is no reason we couldn't create a submission packet that included the actual application. One of the challenges, of course, is to make the application usable by someone who isn't super technical. But I guess I will leave that for a second.

But so, let me go on to file types. So, this is image data. The first way that the image was captured with our systems was just kind of a data dump of the image data and then a small amount of header on the data to allow it to be recognized.

With NEDCC, they were very interested in putting the image data into something that was a little more standardized. And they offered the idea that we go to the TIF format. The data has not changed. It is just a different way of storing the data.

So, that allows -- the advantage of TIF is that the TIF allows for quite a bit of metadata in the header. And so that certainly is a way to

standardized the file formats.

Now, the way we distribute the file formats, because with the 2D system, create quite a bit of these TIF files. And so dealing with all these files can be complicated.

So, the way the library tends to deal with things, they call them solution packets. So, they wrap these things up and create a bundle that can be stored.

So, the way we envisioned, and we have not yet done this in Culpeper, but the way we envisioned in dealing with the different files was to keep all those files, to keep all those image files because those are the primary source. When you convert to an audio file, there are segmented audio files that are created and those would all be wrapped up. And then also dealing with the metadata that would be related to that.

There is a lot of technical metadata that can be captured and currently, there is a lot of metadata that is captured. That could be stored in the headers. That could be stored in a separate

companion file. We have talked about an XML expression of that metadata. We have not done that yet but the idea was to wrap that all up so that that preservation bundle would include all those different kinds of things.

So, another important thing is that currently the way we deal with a lot of the technical metadata is we have mySQL database sitting behind IRENE and so that metadata is captured with each scan and they could be exported and stored but currently we keep it in a database.

So, then I wanted to talk about the problems with some of these. So, with hardware, what are some of the problems? So, let me go through.

Okay, so we have these scientific-grade pieces of equipment that we use but we also have equipment that is more commercially available. The workstation PC we use to control the whole system, it is just a standard workstation. And throughput on that computer affects the ability of the IRENE system to perform well.

So, the specification of the work station is not necessarily in the scientific realm. It is something that is available for all sorts of applications, for business applications, and things like that. So, standardizing on a workstation would be, I suppose, difficult.

So, some of the solutions to deal with understanding how these images actually relate to what we are trying to capture off of the media. One of the prime issues is that we are actually capturing images that we are capturing for the purpose of extracting the audio. So, when we capture the images -- I'm sorry. I feel really faint.

Sorry. So, one of our prime challenges is to try to deal with the fact that we are taking images. What we really want to do is compare it to audio. As I said, the primary preservation format of this system is an image. And to get to an audio format, we have to extract the audio from an image. That can be done in lots of ways. In fact, other talks have talked about the challenges of tracking things, how you actually determine what the audio

is in those grooves.

MS. HENLEY: Is everybody onboard with a break? Fifteen minutes? All right. Thank you for understanding.

(Whereupon, the above-entitled matter went off the record at 2:46 p.m. and resumed at 3:15 p.m.)

DR. FRANCE: So, just to bring everyone back together and Carl is going to just finish up the points that Peter was dealing with, in terms of the software issues, the hardware issues, and the file formats and other components we need to think about in terms of standardizing.

DR. HABER: So, Peter and I were talking and there were a couple of other points that Peter wanted to make and so I will try to state them as best I can.

So, I'm not sure the exact order but one question which people have raised and it is probably too early for this but people have asked the question if you are imaging carriers at very high resolution, what can you do with those datasets? For example,

could you recreate the three-dimensional objects, the three-dimensional printing and would there be value to that?

So, I, personally have been asked this question a number of times and other people have brought it up. And I think the consensus viewed of that is that three-dimensional printing is not at the level of resolution that you would be reproducing the kind of information that you are measuring.

Personally, it is sort of taking an analog carrier, digitizing it, and then turning it back into an analog carrier. I'm not sure there is a lot of value in that but it may have some novelty appeal or demonstration appeal. But I, personally, don't see it as a conservation or preservation model but maybe others do. And when we go to a question and answer, obviously, people are invited to entertain this idea.

So, another point that Peter wanted to make is we are imaging and we are collecting these images and we are trying to extract sound from them

but they are also images. So, when we talk about standards and specifications, are we using all of what the imaging field can tell us about files, formats, data, resolutions, et cetera? So, how well have we managed to talk to our colleagues on strictly in the imaging world and marry these imaging for audio to the more general 2D and 3D imaging field and somehow basically taking water from the same well?

Another point relates to how we do comparisons. So, there is always this question does it sound good or how does it sound, one playback method versus another? What is the relationship between visual audio sound files and IRENE sound files? What is the relationship between IRENE sound files and stylus playbacks and how do we assess these things? So, there is listening tests. There are various measures and so forth. But going through that exercise, coming up with agreed criteria by which we make these comparisons would certainly be something which would be very valuable and would help to normalize the discussion, so that

everyone is, again, reading from a similar script.

And with the Northeast Document Conservation Center, there is a discussion going on now, Northeast Document Conservation Center and Indiana University Archive of Traditional Music, to try and kind of go through that list of comparison steps and understand it. I have been involved in that discussion with Peter, folks from NEDCC and Indiana University and it is very instructive to actually try to figure out. And it has been a great sort of give and take. You know, we write something and then it comes back with a modification, working through those ideas of how you base a comparison. I'm sure we will iterate that. But the field, obviously, needs to come up with agreed upon ways of doing that.

Another thing which Peter wanted to point out relative to this, and also I believe is more generally relevant, is, as Bill Klinger was saying, there is a whole engineering dimension to these carriers that exists in the patent literature, in the documents of the companies, in the archives

of various places where very important information about how these things were made, the shapes of the grooves, the shapes of the styli. And liking that data to the database of the cylinders and the discs that we are looking at, the specific items, that really enriches the way we interpret the data from them. And so I know from speaking with my colleagues at UC Berkeley in linguistics and in the libraries, they talk about cross-referencing the notes of the anthropologists and the ethnographer with the sound recordings and the transcripts and everything in creating this cross-linked way of understanding this information.

So, similarly, we have the cylinder databases, the discographies and the cylindographies, or whatever they call them when it is cylinders. You know the past stylus transfers of them, which may be some of them historical, the image data, the audio that gets extracted and then the specific references to the engineering literature that specifically relate to the machines that were used by Franz Boas or Alfred Kroeber, or

to the extent that we can find out who used these machines and so forth. That really enriches the whole understanding of this data and even the way in which we do comparisons.

So, Peter, I think those are the points that you -- did I do okay with that? Okay, good.

All right. So, now, we are going to have a question and answer or discussion, based on the presentation that Fenella and Bill gave and Peter and I will stay up here and help entertain questions that come up relative to Peter's talk. But it is open now.

Who is going to moderate?

PARTICIPANT: I have a question for both Peter, for Fenella, and for Bill.

Regarding tape and tape degradation, I used to be part of a team of disc jockeys here in the Madison Building that played recordings for patrons, when the collection was here on the Hill. And the way we used to test for sticky shed syndrome was to actually play a little bit of the tape. And if that didn't yield an answer, we would fast forward

the tape. And if that didn't give us enough, after a few seconds, we did some more, until pretty much we would get to the end of the reel and examine to see what kind of shape this reel of tape would be in. So, we were tape destroyers, basically but that is all we had to go on.

And it was my understanding that at the present time, it has been refined a little bit but the basic way of determining whether or not a tape is to be baked ahead of time here at the Library of Congress is pretty much the same. I am wondering, in what ways can we implement your findings, your scientific findings to perhaps introduce a new way of determining whether or not a tape is sticky or not.

DR. FRANCE: Thank you. And as you all know, there is a lot of expertise out there in terms of people working with tape all the time and knowing it so well.

What we have developed is actually this portable tool, which literally, you take one -- and we have done a number of tests on taking spectra at

the beginning, in the middle, and at the end, and so I won't go into all of that. But by taking a spectra off that tape and putting it into the database, because of the unique chemical composition that shows you whether there is degradation, you can instantly then see whether it is going to be classified as sticky or non-sticky. And I know from talking to a lot of the engineers, that quite often, most of the time, they can tell from the tape whether it is sticky or not. But there are times, though, that 10, 20, whatever percent it is, that you just can't tell until you get into it. And so, hopefully, that is why you want this to be an actual functional useful tool for the people working with the collection to literally take the spectra that drops straight into the database. They get the classification. And as I said, we are getting about 98 percent accuracy.

And the infrared tool, it is around $40,000. It is not hideously expensive. So, it is something that is workable for people with large collections who have to do this large volume

turnover. And I am seeing Brian in the front row here. Some of these people who are on the front lines know much better than me the challenges and the frustrations and that is part of what we want to do, just to make life easier.

PARTICIPANT: Thank you. If I may, I would like to ask Bill a question.

I am wondering if you could take this opportunity to elaborate on your feelings about the wear in brown wax recordings and how this damage that you referred to as being kind of rampant is occurring and just what measuring tools you are using.

MR. KLINGER: No one is measuring this properly. That is the issue.

I think the problem really begins that it is very possible to take a stylus that you happen to have and play a record and it sounds okay. Maybe it sounds perfectly fine and you might be damaging it while you are playing it and you probably don't know that. And I think the collectors are doing that every day with styli that are too small.

Edison understood, as early as 1889, he

would have rather play back the record with exactly the cutting stylus, and that is still the physics of it. If you want to get the best match for the cutting, play it back with the same stylus shape. You will wear the record if you do that, but think of these microridge styli, styli that have an incredibly broad bearing surface that spreads the pressure across the surface of the groove and an exquisitely thin scanning edge. People are making those things today and they don't harm the record.

But using a 7.5 mil spherical radius stylus when it ought to be 17.5, that is a real problem. The sound is okay but there is going to be wear and that really needs to be quantified.

DR. HABER: But even with this microridge device that you are talking about, shouldn't the question of whether it causes wear also be evaluated?

MR. KLINGER: Absolutely.

DR. HABER: Because it seemed like you were saying that we already know that those don't cause wear but that ought to be on the table.

MR. KLINGER: Those things have been examined in the industry and they are pretty good on vinyl. And vinyl --

DR. HABER: Oh, on vinyl. So, they are meant for vinyl.

MR. KLINGER: They are meant for vinyl.

DR. HABER: Oh, so they are not cylinder.

MR. KLINGER: No, no, strictly vinyl.

DR. HABER: Okay.

MR. KLINGER: Yes, I should have clarified that.

DR. HABER: Okay.

MR. KLINGER: Thanks, Carl.

MR. STORM: A take up on Bill's point. One of the major things that I think really needs to be brought back time and time, and time, and time, again, the purpose of an archivist is to save history, not to rewrite it. And part of the problem that we have is that we start on a path of saying we are going to be objective and then we immediately retreat, not immediately but over time, what keeps

being brought up, which sounds better. That is not the question. It is what is the most accurate reproduction of the signal that has been captured, minus the equipment that first recorded it and is playing it back.

That is your job as an archivist. It is not to become the producer of a new thing that sounds better. And the tools and the points that Bill is making is that if you don't understand the beginning of the process and what you should be doing, and you don't even take that into account, you are doing the job wrong. It is very important.

Now, I am saying this not as somebody who has thought about this just this morning. I have been involved with standards for over 35 years and I was the founding chair of the audio engineering society's preservation committee. And the goal was, again, save history, not rewrite it.

And as we go forward, a couple of things need to occur and I will let Bill embellish upon this. First, people who do the traditional methodology are damn good people doing very good

work but they don't have, for example, the information that Bill has.

So, as a starting point, these people who are very good people and you have to respect, minimally should know what he has as information. There should be, literally, a book that says here is what you should be doing. Here is your starting point. Because again, that is what you should be taking into account, not just trying the needle hither or thither and say oh, it sounds better. I don't care if it sounds better. I want to know the most sterile version you can make without becoming the new record producer of the sound.

Now, you take that same issue and now you go into the optical world, it applies equally. And when you go into the optical world, as I understand the way the systems work, is that we are now going into what I call hybrid signal processing. Audio signal processing, as it is traditionally done, is very limited. It is trying to guess by frequencies, oops, here is something wrong, oops, here is something wrong. That is nice and you get

to a certain point but most engineers that I have talked to say you know it doesn't work. You know, I would rather some other techniques, use my equalizer, or whatever. I'm not really happy. And what they are doing is they are raising the threshold that they learn a pattern, they rush, the thing is so high, it now distorts the signal and they totally discard the whole idea of using digital signal processing.

Well, part of the issue and one that could be solved with the new technologies is they are looking at the wrong place and the wrong kind of signal processing. We now can look at the material itself and say okay, how do you apply signal processing to the material, the carrier? The carrier is now an image. I could look at that image.

In the very simplistic terms, I could relate it photography, for example. There is all kinds of things in Photoshop, for example, the Healing Brush. If I look at an image and if I want to get to that level of pixel level and say oh, that is not sound, I know it is not, what can I learn from

that? I should be doing image signal processing and I will get rid of more noise than I can with traditional audio signal processing. That is the goal. I don't mean it can be done tomorrow but the goal is to understand what is the cause of the noise. The cause of the noise is mostly the carrier. So, how do you get rid of the carrier and get down to that sterile version that says what is left? After I get that, most likely is closer to the sterile version I want of the audio.

So, I think it is important. Please, don't rate which sounds better. I think that is not a criteria at all. If it sounds lousy, it is because the signal was lousy. If it sounds good, somebody did a very good recording job.

And then the other part that you go to, and I hope Bill picks up on this, is once you subtract the mechanics of the original way of playback systems, you got this magic thing happening. Carl used -- this is true flat as opposed to you pick some stylus and you say I recorded it flat.

If I am in Archive A and I pick one stylus

and I am in Archive B and I pick a different stylus, you are both going to claim it is flat but it is not. You subjectively have changed that and actually added noise that didn't need to be captured at all. And so the philosophy of here is flat recordings forever, they are not flat at all. You have introduced noise.

The system that Carl has has the capability of actually giving you truer flat, without subjective intervention.

The other part that can happen, if you go to that process, is you can now say if I got rid of the playback created noise, can I now think about the original recording processes? Can I reengineer, do reverse engineering to actually try and understand the limitations of the original recording system?

So, for example, when you talked about cylinder recordings and say oh, I can give you a profile of that, I have a pretty good understanding of what is going on with that.

Well, Bill can do with what he has, and

the knowledge he has, and could integrate into this, and say let's reverse engineer, based on what we actually do know about systems. You can do 3D modeling, including acoustics and physics to say all right, if it is this particular machine, then I could probably simulate what that machine would have done, in terms of influencing the original recording. And if I actually wanted to hear that machine in the future, I could make it a plug and bloop, this is what it sounded like through this horn, bloop, this is what it sounded like with this playback device.

So, I know I sound passionate about this. You know I have been doing it for 35 years and I always get upset when I hear people say let's just see which one sounds better.

Bill, I would like to hear what your attitude is on that.

MR. KLINGER: I couldn't say it better, Bill. I appreciate your speaking up and speaking your mind. I think that your ears can tell you when something is horribly wrong but there is only a few people who can really discern subtle nuances between

technical playback.

The ear is a great tool. It probably ought to be the final arbiter but people aren't even beginning to use the measurement capabilities and the metrology that is available to us.

People tend to grab a magnetic cartridge and a stylus that they have. If it works, if it gives them sound, they are done. They move on to the next one and they have no idea what damage they are doing and how much better the sound could possibly be.

The magnetic cartridge itself is a horrible compromise, trying to playback early acoustic records. It is a horrible compromise but it is what everybody has. It is what everybody uses. Carl is paving the path for the whole future.

You could substitute a different kind of transducer for the magnetic cartridge without doing imaging and do a much better job but no one has put the time, effort and money into any of that.

MR. FABRIS: I would like to slightly counter something that Bill Storm said. He said that people who are transferring cylinders don't

have the information that Bill presented. Your information has been available for about ten years. It has been out there.

MR. KLINGER: To a select few people. I have never published all this stuff. I have shared it with you, with David Giovannoni, and others.

MR. FABRIS: It has been circulated quite widely.

MR. KLINGER: Okay, well thanks. I didn't know.

MR. FABRIS: The issue is, I would say, more that the optimal cartridge and styli for cylinder playback isn't available. It hasn't been designed.

MR. KLINGER: That's right.

MR. FABRIS: And I think had there -- this does relate, I think, to the promise of IRENE. So, the difficulty here is we are kind of in this holding pattern of do nothing. Some people are saying do nothing; wait, wait, wait, wait. So, I think that is more of the issue.

MR. KLINGER: Yes, well you might

remember, Jerry, we started ten years ago with an NEH application, a proposal to do calibration records, stylus selection guides, the whole thing. It got turned down because some academic who reviewed that application said why do these guys need to do all this stuff? Why do they need calibration records? Just play the records.

That was the attitude by someone who reviewed the application, even though we had 21 letters of support from the Library of Congress and every other audio engineering society here, in Europe. ASA, ARSC, everybody was behind that but we got no funding. We could have done all that nine years go.

Sorry to get heated about it.

DR. FRANCE: This is great. I am going to come from a slightly novice perspective, so forgive me.

But I am glad to hear these discussions because I think what we are really saying here is that IRENE is capturing an optical capture and we need to focus on how do we standardize that capture

from the optical perspective because you will have the knowledge of the other components. We do a plugin of playing it to hear the different sounds.

When we did the spectral imaging, we didn't try to reinvent the wheel. We looked at what was out there in terms of geospatial standards and other standards that were already out there existing in terms of imaging. And I think what my feeling is, just hearing from discussions this morning in terms of how do we fund this, and how do we move things forward, that you do need a consortium of a number of institutions, of academic partners of the main professional organizations. I think the time is a lot better now than perhaps a few years ago to really push this forward.

From talking to some of the funding bodies, they are starting to understand perhaps who they should be having review some of these proposals, which they may not have done in the past.

But if you have a cohesive approach in terms of the standardization, I think it does help to move this forward and that is my two cents.

But I really think that being able to standardize and not just have it nationally but internationally is a really big focus. We just had this discussion in London a few days ago, where we are saying we need to raise the profile of, for example, heritage science. I think this is the same thing. We think we are just a very small group but I think what Jim said this morning or someone said this morning, these applications to a lot of industry components, it is not just alone. And while the cultural heritage is a very strong proponent, we are clearly not where the funding goes, but we can use and leverage some of these partners to move it forward. So, sorry, I get passionate about that, too, but we can do it.

DR. JOHNSEN: I have problem about imaging versus needle. Image needle not always the bad guy. The needle does three things at the same time. It creates the sound. It works like a brush, it cleans the record. It works like brush, it destroys also a little bit of the record.

That is why in many cases, a needle is

the best. The needle is the best for records in good condition. And imaging, in my opinion, will be for record would be dangerous to touch and it is dangerous to clean because the needle is cleaning.

And what I believe we need is really like a microcamera with a microrobot that follows the groove and has some small vacuum cleaner to absorb or to push, to try to clean up at the micron level. But that is far away, I believe.

MR. NYE: We're moving into the period of wrap-up, I suppose. And I would like to ask a specific question but with an ulterior motive, that is a larger motive, and that is specifically, Fenella, would you say more about the science -- the heritage science storage and the collaboration between the Library of Congress and an Italian institution?

The reason I am asking, in part, is that I do think that whatever comes out of this conference needs to take into consideration a large number of factors. If we are thinking about trying to do something that is summative here during the last

hour or so, or begin to move in a summative direction, it would be nice to think about how the various components could come together in ways that would be maximally effective, both in terms of the science, the technology, the institutional components that have to come into play on funding and all of the rest of it.

DR. FRANCE: Thank you. So, this is something that I am also -- I get very passionate about lots of things.

But one of the challenges is that we are public domain and we are capturing all this data but how do we get it out there and make it available? And what I am hearing a little bit of a common theme is certain pockets of people know things but it is not getting out there.

We started a few years ago trying to look at how we -- what could we develop. That I am very much against reinventing the wheel. And so we had a meeting, a three-day meeting here in December of last year where vote upon some of our initial collaborations with Italian colleagues and that

been really looking at what is the research infrastructure you need to share data to make it available? What sort of format should it be in? How do you move forward?

What currently happens is the science is separate to the humanities component, which is something I strongly resist. They need to be integrated. And so we have been having some excellent discussions. I did a presentation at NEH who really were on board, at the point now where they say oh, we should be doing this. Well, so many of us have been doing it for years but if people are supporting it now, it is a great thing.

We realize, in fact, though, that to get that support, it needs to be global. And one of the challenges, I think with the funding component, is that here in the states, it is very much private funding, as opposed to the public funding, which is the case in the EU. The EU are forced to actually collaborate and create collaborative ventures because of the way they are funded. And while I am not saying that is definitely the perfect model, it

does mean that we need to look at how we leverage a move forward.

We don't have a ministry of culture here in the U.S. and that means we don't have someone from on high looking down and giving high level support for all of these ventures. And so one of the things that we have been looking at and I think something like IRENE would fall under this very nicely because it is a combination of the capture from the material object, the scientific capture and then the interpretation is in terms of moving that forward, can we actually create a structure, an infrastructure that supports that component?

And so one of thoughts was, and this is still in very early discussions, if we have a number of institutions, if we had the Smithsonian, if we had the Library of Congress, for example, we have been talking to the National Gallery of Art, three or four large academic institutions, is a central node or hub to begin these discussions. It gives you something to move forward. It gives you someone to look to. It means that you can start to develop

standards, put something out there for other people to respond to.

And this seems basically a lot -- after talking about this for about five or six years, it seems in the last year and a half, a lot of things seem to have sort of slipped into place with the way people are thinking about how we approach data, the fact that we need to make it openly available. Whether we start with a pilot approach and move forward from that with an archive that is available, I think as people see that and realize the importance and the value, it starts to gain impetus.

And so while it is great we need to do it at a global level, I think we have to have that national consensus first to be able to move forward.

We have been talking about clearly we are all competing for the same funding bodies and, frankly, they are not large amounts of money. And so what we really need to think about and I think it was Bill, you were saying we have got to think big. And I think that is true. We can't keep saying we will take $30,000 and that is great. We can do

400 discs. I'm just making numbers up here as an example. I don't know. But we need to say yes, who is the philanthropist who will give us $4.5 million or maybe that is not enough, but once you get that, it then starts to build on itself. And I think that is the problem. We always tend to step back and be afraid to ask for what we really need. We just ask for what we think we might be given.

So, it hasn't solved any issue yet but I think we are actually in a good place with people internationally are really starting to think about the issues, the fact that we want to have open source. The fact that, as Peter was saying, the underlying software here is open source so you can share components.

As I said, I am not getting into the IP issue at this component. But what is available that we can put out there as pilots and really start to move things forward? I think Carlene gave a great example of the interest that was generated just from a small number of sound recordings. And that is part of it, raising the public profile and seeing who else

is out there is interested. And leveraging industry, I think, is a large component because once we look out there and see who from a different industry can actually use some of the technology, some of the skills that help us get that buy-in as well.

PARTICIPANT: Can I just add? I thought that was pretty inspiring what you just said. And I think we can just look to the Save Our Sounds Initiative in the UK right now, where Will Prentice has been leading, where they have actually, first of all surveyed and gotten a sense of all the sound collections that are in the UK by asking people to just tell them about them. And then they have used that as the basis of first of all, of a 9.5 million pound Heritage Lottery Fund grant that came through about a month ago. And now they have just explained that that is only the beginning of what they are hoping to get and they are going to set up nine regional transfer stations around the UK in order to start transferring really the whole nation's sound archives because they are using, they

are explaining they are endangered. And I think that is a pretty amazing project that is going on up there. And I think that is looking to do exactly what you just said. So, I just thought I would mention it.

Going back to what Bill Storm was saying, I do think that -- first of all, thanks to everyone because this has been a really amazing few days and I have really enjoyed hearing about all the different projects that are going on around the world and that has been really great to hear about the different ways that people are approaching the problems that we are facing. And I think that what Bill is saying is that given that when you go from sound archive to sound archive, even in the digitization world, not even taking into account IRENE, we have never established standards, really, in how we are transferring recordings. And that is something that has just not been properly done.

And maybe now that we are moving into a new area where possibly some of the issues that we have been talking about would move into a whole

different realm, maybe it is time that we did talk about these standards.

But I do want to say that I agree with what Bill said a few minutes ago that we need both systems because there are certain -- I have got 22,000 cylinders and many of them are not appropriate for IRENE treatment. They are just not. They are not endangered in the way that I think IRENE -- but I do have some that I think would be fantastic if IRENE were to be applied to them.

So, I think we need to but I would like what comes out at the end -- I don't want one system. I want what comes out to be consistent. And so as somebody who is a director of an archive, I would like these standards so that in the end what we are getting is consistent, regardless of how they are transferred. And I think that is another reason why we need to be talking about standards and we need to be thinking about what it is that we are getting, despite the way whatever it is transferring from one medium to another has done.

But I think it is fantastic that we now have options. And I think what is really amazing is that we can now be talking about transferring so many objects that five years ago were considered unlistenable.

MR. STORM: Have I shut everybody down? We are not talking? Let's go big again because I think it is important to go big again.

We no longer have what is called broadcasting. We have what is called multicasting. Everybody in the world is a broadcaster. There has never been a time in history when so much media is going so many places by so many people. And part of our obligation is to take control of some of that. Including, if we can conceptualize not necessarily IRENE, maybe IRENE2, or 3, or 4, or some competitor, or whatever, there should be a universal player. And that is becoming a reality with what IRENE can do. There really is.

If you could afford it, if everybody had an IRENE or something and IRENE should be calibrated against another competitor, and set up some kind of

standard, then you can now truly have global exchange and truly a world-based archive.

If every archive said look, I know when I put my recording in and I put it in in Switzerland and I played it in Syracuse, or I played it in New York, or I played it in Hong Kong, I know that it went through the same process that I am doing it here. And that process, hopefully, is living up to a standard of being objective and I don't like the word but maybe that it what it comes to. It is sterile. I haven't manipulated it.

So, standards have a tremendous impact and the interest in media has never, ever been like this. As a matter of fact, one of the biggest calls I get for consulting now is not on archiving. I am getting all kinds of calls for consulting from newspaper people and other people who are losing their jobs because they have been in the business world in journalism, print journalism, and guess what? It is disappearing to a level where they no longer are employable unless they can go out with a camera and not just take a picture anymore but they

also have to do video. And video is part of -- oh, by the way, there is sound in it, yes. They don't know how to do sound.

So, the educational process that you are going through here is that they come up with new curriculum now. They now call themselves storytellers or they say we are doing multimedia. I'm sorry, that has been done for the last hundred years. It is called motion pictures and video. It has already been a multimedia world forever.

But when you have a culture that says here is print and the print world is separate from the media world, non-print media world, there are cultures that have been -- I know when I first got involved with this in the library community, the walls were very thick and high. The funding was on one side and not very much on the other. It is flipping. So, you have good reason to think about big about what potential funding is because if you set up an archival model that is globally capable, you could do this even at your own university, I think it is one of the things that ought to be done,

is how do you exchange information in your own university institution? Can you truly just go and say okay, I am in Department A, and I am Department B, and I am Department C, and where is all this stuff archived? And oh, I got a bunch of media, well, we never did that. Or how do you do that? What are the universal standards that we have to think about?

And when you start talking about imaging, this becomes a lot easier not just for sound but all media types. That is your model. That is your big model. If you look at all media types and audio being a very critical part of it, and people are finally starting to recognize it is, then your potential for funding doesn't come from somebody talking only about sound. You can now talk about anybody who wants to manage an archive media as a whole.

And now if you have the best mousetrap for doing the sound part, fantastic. And if that is where your focus is, great, that is fantastic. But you should also be working with people who do images, still and moving, and print people, and show

how it all comes together and it is all datasets. So, that is where the future can be.

And I will continue my passionate play right now just for one more second. I don't think a lot of us recognize just what an important moment in time this is. There is only a handful of people here who are going to make some very big decisions. A lot of the people here are going to influence the way people like Carl thinks, a physicist who is among us now, not typically what we have here.

DR. HABER: Everybody just keeps saying my name. I have a lot of colleagues that --

MR. STORM: And colleagues. And the colleagues, they know I love them, too. That's it.

But the point is, if we are going to talk about standards, you have got to give them input about what archiving is about. Not just what you feel about it but unfortunately, the sterile version of it because I think that is important.

Now, if you disagree with it, that is fine but I don't know any other definition of archiving, other than saving history and not

rewriting it.

So, right now, it is confluence. We have got traditional archivists doing trans work in a certain way. We have to respect that. And what we have to do is set up a collaborative arrangement between the traditional way work is being done with people who are trying to advance and bring in new technologies and do that in the context of a global library because it is doable. Anybody can do that right now.

So, I think I have said enough.

DR. HABER: I will stand up because I can't see half the room from behind this podium.

So, there has been a lot of discussion about the need for standards. And so in thinking about that, and then talking to a lot of people, to me, we have to tease out because there is sort of three things, actually. There is standards. Then there is consensus, which is the process of people in a field agreeing on something. And there are many things that we might agree on, decide to agree on, or maybe never agree on. And then there is -- I don't

know what word to use, but there is like understanding or absorption of the fundamental concepts, so that everyone is talking about the same thing when they talk about something.

And so like interacting with this community over ten years or something like that, I have kind of struggled with some of these things.

So, I worked or work in like the physics community. And that has a culture and it has a way of doing things. And after whatever, I have been in it 30 years, you get used to it and you learn how to work in that environment. But really, there is a very strong consensus in that field when it comes down to doing something. Because somehow the language and the concepts are shared. Everyone is educated in a very, very similar way, whether you are from Japan, Switzerland, France, you all learned Maxwell's equations and everybody agrees.

So, the force of consensus is pretty strong. And then people get into huge fights about should we do the experiment this way or should we do it that way. But these things get worked out and

challenges are set up and things have to meet certain criteria and then they get worked out and they move on.

So, when I came to this community like 12 years ago or something like that, I was really struck. I was worried. I am an outsider. I don't know anything about this subject. How are people going to react to somebody coming in with suggestions. And I found this community to be extremely open-minded and willing to engage in the discussion. And the people were very serious about what they were -- the responsibility that they had as custodians, caretakers, guardians of these collections and all of that.

So, I really liked working with the community of people that was taking this thing very seriously and was like willing to explore these new ideas. And I feel like it was pretty good.

So, I think the culture of the community is great and it is able to like do things and move forward and try ideas out and it is an open-minded community.

But I think this idea of like standards, consensus, and what is the word to use, but sort of fundamental principles, still needs to be worked out. So, when I say fundamental principles, I still find that when you sit and talk with one person at lunch, another person at coffee, when you get down into the technical details, there are different understandings of fairly fundamental things that from like the physicist point of view or the mechanical electrical engineering point of view, actually are pretty clear.

And so there is a sort of education or explanation process that we should somehow go through. I kind of imagine that there should be a basic textbook that gets written, and I don't really mean in the sense of a book but somehow a document that works out the fundamental engineering and science behind what we are talking about, be it how recording machines work or how imaging systems work and how they interact with each other, and how magnetic stylus work.

We need a sort of textbook that kind of

puts an end to a bunch of arguments that are really not true arguments, in the end. Their kind of opinions or belief systems, a bunch of that stuff that I have encountered, it is historical baggage and it needs to be clarified.

And I think somehow we need to write this book. And I don't know exactly how it gets written but I think we need that book. Okay?

Then, there is the question of consensus. So, an example of consensus is, for example, you were saying that you have 22,000, or whatever it is, cylinders and there are certain ones that you will play and there are other ones that you think you shouldn't.

Okay, so you have some criteria that you would apply and Jerry said a similar thing at lunch but maybe Jerry's criteria isn't the same as your criterion or maybe one is stronger than the other. Somehow, this ought to be just something that we develop consensus on. And if somebody doesn't agree with that consensus, that should somehow be vetted. And in the end, I feel like this is a

community that is capable of walking away from a discussion like that with consensus. And maybe the consensus is you know you never play a lacquer disc or you always play a celluloid cylinder. I don't know what it is but I feel like you could develop consensus.

And I think consensus is a little bit different than standards. Standards means more to me like what is the number of samples that you make. What is the ADC rate or the sampling rate or a bunch of things about how the operator analyzes the data or what the image data should look like, or should we be working with the 3D metrology community, which is a huge community and has standards for 3D datasets and so forth.

So, somehow I think we need like the rulebook. We need the consensus, which is the moral and ethical foundation of the field and then we need the standards that relate to how things are done.

And you know I guess IASA has put out, there is a TS something or other. So, there are these books and treatments. And the Library has run

these workshops through CLIR about how you deal with analog data and how you deal with digital data. But clearly, they are not -- not to make a pun. Clearly, they are not enough because we are still arguing in meetings like that that we don't know the answer to a whole bunch of those questions.

So, I don't know whether you have a panel or a working group and under whose auspices it is but I really feel like we have got to agree on the fundamental science and engineering issues behind sound recordings. There are people around that have this knowledge about various overlapping subsets of this. You need to reach consensus. And then, of course, you want to have standards.

And then finally, I see this done extremely well, like in the astronomy community, for example. The astronomy community, they build like huge telescopes and they are great at getting money because they have these pictures and everybody wants a poster and so forth. And they get huge, philanthropic stuff to build telescopes. Telescopes are hard names. The names are the names

of rich people. Okay? No other field of science, except maybe aspects of medicine do as well as the astronomers in this way. And the astronomers have a decade plan and they make a list. And they get together and this is about consensus not about what media to play or what starts, but what are the important scientific goals for the community. And you have things like this in the national plan for audio preservation and stuff like that.

But if you want to go, and I am not any kind of an expert at dealing with foundations or philanthropists. I have not done that. But and I don't know where you draw the line and say this is afield but if our goals was, for example, to spread the gospel of optical scanning and create, instead of five or six machines, 20 of them or whatever you goal is to create and audio transfer matrix with all the tools from the stylus as some kind of a -- think a kind of decadal plan, it is work for the astronomers. The sky is the limit, as far as they are concerned.

Okay, so those are a couple of points

that I wanted to make.

DR. FRANCE: And can you just respond? I feel like I am kind of having a deja vu moment because this is exactly the same basic discussion we had in terms of heritage science. The challenge is people don't necessarily see cultural heritage or heritage science, preservation science, to use that term, as an academic discipline.

And what you are describing is what are the underlying concepts that drive that discipline that we all agree about that defines the field specifically. And I think that is one of the things that needs to be established to some component to move this forward.

What I also want to note is that I think one of the things that often holds us back is that we think we have to be right at the 120 percent agreement right now. We can never be there. So, even if we define a standard, it is essentially, an ongoing developing process and we have to agree that right now this is what is doable, this is what the general group accepts but it doesn't mean that it

doesn't ever change, that it doesn't improve over time. I think that is something we need to think about in terms of what can we really do.

Because what I am hearing from people out there is we think this is a good time. We want to do something. Let's keep the momentum going forward. And so what I want to sort of throw out to people, based on what Carl was suggesting, I think that is a really good thing to say, who wants to be involved? How do we draft out kind of a mission statement, so to speak? But what would be the next steps? How do we move forward?

Do we create some pilot projects? I started talking about NEH but they were saying in terms of the research infrastructure while we can't get direct funding at the library, they would support other institutions who wanted to work with us. I see IRENE might be a nice component that they would help a pilot component go forward.

So, next steps? You all want to jump in there?

MR. PEARLMAN: Hi, so I have been

listening to this discussion. You know I wish I had a bottle of say Calvados next to me so I could calm myself because some of this discussion seems like meta-unrealistic to me. You know the playback of audio objects, both analog and digital, of course, is a situation which is totally immersed in the subjective. I don't mean how do we react to a piece of music, I mean that the playback conditions vary infinitely. I think it is fair to say that, actually. The technologies of playback vary infinitely, even within a constricted domain like analog design or constricted -- theoretically constricted domain like digital audio design. There are so many conditionalities that I don't know what the definition of an objective or pristine or whatever term you use playback would be, or an agreed upon universal recording technology or universal restoration technology. You know unfortunately, Alan Turing is dead. So, whenever I think about universal machines, I think about him but he is not around to help us any longer to design these things. It's a joke. I'm not trashing people working in this

field right now. I just wanted to remind you where some of this came from.

But I just don't know what it would be. And further complicating the situation is that so much about, for example, analog, so much of what we love about analog, and I was very happy that you actually discussed this yesterday, deals with, is dependent upon the manipulation of noise. And things that one engineer may define as noise are defined by other people as totally attractive, unimpeachable analog artifacts.

I am an analog fanatic. I am a member of the analog first front for music and for film. Okay, my time has probably passed.

But having said that, I think so much of the database that we are dealing with is of analog origin and what exactly would be the objective, pristine, sterile playback mechanism, signal path, whatever, to get back to the before, pre, the original playback situation? I am just puzzled. I don't know what objectivity we would need in this case.

And so much of what I did involved working out of spec, of using the equipment. Well, fortunately, I was successful enough, and sold enough records so I could own the studio. I could whatever the hell I want. If I wanted to bust some stuff to get a sound, I could do it.

When I was teaching at McGill, the other people there -- I'm not talking about George Massenburg. George Massenburg understands out of spec. But a lot of the people I was working with were just appalled. They didn't want to set me loose teaching production and some aspects of audio technology, even though I had sold about 40 million records, so I must have known something as a producer, because they were afraid I was going to destroy equipment, some of which I gave them or got for them and they had it only because I had gotten it from the manufacturer for them. That is another story.

So, I could rotate around this axis for a long time but I think this is really a valuable point to bring up.

DR. HABER: But would you agree, that as Phil Storm was saying, if we give you a representation which somehow it is agreed upon that it has sufficient resolution and it carries no playback baggage on top of it, that is like a preservation ideal. Because then, you can add any analog option on top of it that you want. Is that what you are asking for?

MR. PEARLMAN: I think the embodiment was in the noise matrix, which you discussed yesterday. I may be describing it in a way that you don't subscribe to but I think actually it is an accurate way of describing the real situation in the real world.

There are expectations built into that. And what we have come to love and admire and miss, and not just in a nostalgic fashion about following the depth of analog as a dominant technology, is a kind of pining for the euphonious results that the embodiment in the noise matrix gives us.

DR. HABER: But shouldn't we give future generations the option to also fall in love with that

or fall in love with a different sound that they might choose?

MR. PEARLMAN: You know, I don't know. I can't answer that question because I think so much of what the engineers and producers and artists were intending to do when they created these works, these recordings, was greatly dependent, far more than we imagine upon the euphonious effects of embodiment in the noisemakers.

DR. HABER: Okay.

PARTICIPANT: I was going to say something entirely different but you started this debate, which I am not going to propagate, but I must say in this case, I don't agree with the Berkeley Group there are some artifacts that are inherent, naturally inherent, physically inherent in analog reproductions which don't exist in digital. For example, the inertia of the whole system. It is a mechanical system. There are certain inertias that you cannot remove that are part of the system. They are inherent to that. They are just as inherent to the analog system as any bit is to the digital

system.

DR. HABER: They are inherent to the playback or inherent to the recording?

PARTICIPANT: To both.

DR. HABER: Okay. But you can model any --

PARTICIPANT: You can. You can but is that preservation?

DR. HABER: No, but that is an option that you throw on top of --

PARTICIPANT: I understand that. I understand you can do marvels with digital programming. But the real original had all of this stuff in it. So, if you are removing that, are you really preserving the original?

This is a freshman debate and I didn't want to start that debate. It is a little too much of a technical issue.

What I wanted to talk about was what you and your group said earlier about common culture and common values. And I think the way you instilled that as a theme for us as a group to do or to stimulate

other people doing is to start teaching courses.

There are audio engineering curricula in various universities. NYU and, for all I know, UCLA, those places should have them. And I don't know if there are courses in preservation.

That is what you need to do and that is the way you get books written. A professor has a course and every day, the night before the course, he puts together some Xeroxed notes and you give them out to your students and pretty soon you have got a textbook.

So, I think that people should get together and institute courses at places like NYU and other places to create this common culture, create a cadre of people with these common values. It is what is done in physics.

And beyond that, it is relatively cheap and it has good PR value. So, I think we ought to be looking towards -- in that direction.

DR. FRANCE: And I think education is a huge component.

I just wanted to jump onto, again, my

slightly naive perspective but one of the things in terms of an artifact object, whatever you call it, whatever field you are in, how do you define the current state? Because we don't know its absolute original state. We are only capturing the sound right now and I think the other component is, if we don't have the playback mechanism and we don't have the expertise of you people who have so much of that, all we can do is capture the current optical sound recording from something that can't be played back, and then allow you to lay those other components on.

MR. STORM: I'm so glad that you are here because in the past I have written things. It is like texting; you write one thing and somebody interprets it a totally different way and you say what on God's earth did he just say? That is not what I meant. And this is a case of not what I meant.

I just was in Memphis a few months ago, Sun Studios and it is like hallowed ground. The sound that was done there, the way it was done, it was all a part of the gig. It was wonderful. When I am using the term sterile, I have never run into

a recording engineer, which I was a record producer, et cetera, that ever said okay, I am going to hand this over some day so somebody else can re-record it and make it sound different.

And what I mean by sterile, in fact, is exactly what you are asking for, is to try to preserve as best you can what the intent was of the original recording engineer in the process. And in some cases, for example, like I would be really curious to say gee, I can profile what the Motown sound was. It had a very definite kind of a sound. I can profile maybe the technical sound you were after. That is, in fact, a goal. It is just the opposite of the way you interpreted it. So, I am glad you are here so I could say that.

The point is not to have some archivist then layer on top of that their own EQ, add some reverb. By the way, why don't' we send it to a mastering house? Because they could really pump that up on digital right now, use a multiband compressor and a few other tools and it will really rock and roll and people will think that is

fantastic. It just totally changed everything you just devoted your life to. That is what I don't want to see happen.

PARTICIPANT: It happens to me every day.

MR. STORM: I'm sure.

PARTICIPANT: I cannot indulge about it. If I was Jimmy Page, I could indulge in the luxury.

MR. STORM: But do you see, we are in agreement? We are not in disagreement.

PARTICIPANT: No, actually I don't really much care what they do with what I have done.

MR. STORM: Well, I guess you are popular.

PARTICIPANT: If they pay me, that is good enough. You know and to be paid these days, as discussed it earlier, is such miracolo. You know that really should be good enough.

MS. STEPHENS: I would like to get back to Fenella's question about what do we do and Carl's comment about community and consensus. And maybe

it is a common language, the third plank in the platform.

I don't have a solution but I think your suggestion about institutionalized course work is a good one.

The astronomers, I know, meet -- the American Astronomical Society meets twice a year. They have at least one journal, probably ten. I don't know that there is like commonality in a group like this, where the universe embraces recording engineers and historians, and cultural heritage, scientists. I mean the universe is different here than it is for the astronomer. I think it is a fundamentally different group.

But one group that I have hung out on the edges of is the frequency control engineers and the subset of timing engineers. And I know that a subset of that subset is debating and has been debating for several years, through an international body called the International Telecommunications Union, should there or should there not be leap seconds. They have identified one

problem. They gather routinely to discuss it. They don't necessarily have a timetable that they abide by. They have a timetable but they don't really think they are ever going to actually come to a vote.

But they have identified a problem and it is very clear what the problem is. They have developed mechanisms for speaking a common language over time. And they meet regularly. Did I already say that? Was that number one? No.

Anyway, it seems to me that we are on our way, maybe to defining what the problem might be. It is probably not a single problem, even. And then meeting more frequently and sharing the information, things that get written down really need to get circulated or something that addresses the entire universe of requirements isn't the word -- interest.

DR. FRANCE: And I think --

MS. STEPHENS: So, I don't have a solution but I think maybe the timing guys have a way to go.

PARTICIPANT: Do you know who serve on it?

MS. STEPHENS: It is literally the people who build, maintain, calibrate, the clocks of the world, the time scale, the pooling of atomic clock time.

DR. FRANCE: And you know I think it is interesting what you have described, Carlene, because that is sort of, again, that difference between a core academic field being structured on something and the fact that we are truly multidisciplinary and how we all have a different perception of specific components in the language. You know you say something, I hear something else because of my background, and vice versa. But how do we create enough of that language, so that we are intermeshed where it needs to be.

MS. STEPHENS: And one of the things that struck me about this gathering is that it was clear when we started that everybody was speaking a different language. And just the fact that we were able to talk together over the course of however many

days this is, I think that is a start, I mean I really do.

I don't find it frustrating at all. I think it is encouraging. You have been at it longer than I have.

PARTICIPANT: I would like to add a voice representing yet another language that I have not heard from in the sessions, and question and answer sessions that I have attended, and that is from the performers.

I made my living, for many years, as a musician. And I am a pretty good musician. I'm not a great musician but a good musician and I like to listen to records. And I think I know something about what sounds good and also something about what sounds neutral, that is with all the noise and all the crackle and all the hiss.

And I feel that without some background and experience and understanding of performing, whether it be music or whether it be acting, or a combination of which, performing in opera or being rhetorical, without some understanding about

standing up on a stage and recreating that has an artistic and poetic lilt to it, I don't think one can accurately address these problems.

And I hear talk from a lot of people who I don't think have an understanding of the performance. And I don't mean just being able to pick up a guitar and play a couple of tunes but be good.

I want to encourage more people who are performers to enter this fray. Thank you.

DR. FRANCE: And I think you raise an interesting challenge, which has been faced, particularly with modern art museums who have artists who are still alive. So, in one perspective, you have the institution that is charged with preserving this material and then you have the artist wanting to have input.

And I completely hear what you are saying but I am not sure how we mesh those two because I think we are coming at them from different perspectives.

PARTICIPANT: While speaking about art,

I am in audio restoration and preservation. My mother is in art restoration. So, I grew up surrounded in and growing up in museums and galleries all over. So, I am wondering if audio preservation ever considers or takes notes from art preservation, which doesn't try to make it sound the brightest and boldest.

But like with art restoration, we are trying to restore the content as much as possible as the viewer of the time and as the painter had that particular work. So, in audio, are we trying to lift as much of the content of the time that the carrier was created? Or as you were saying, audio deforms over time and then changes, so are we just trying to lift it as much as today's deformed groove? So, I think with music, it is such a challenge because music has changed with time and these carriers have changed with time. So, our ears and our minds, we are so subjective when it comes to what we think is right with what and how it should be preserved.

DR. FRANCE: And I'm glad you used the term restoration because that is an ongoing

difference, perhaps between the US and the EU, for example, in terms of how we approach. They use the term restoration because they do often want to restore it back to what they think it looked like. Whereas, we are saying we are preserving what we currently have now because we can't -- who has the right to say what is the perfect time that this painting was optimal or how do we really -- and that is where I think we really continue to struggle with that restoration versus preservation component, which sort of ties into what a number of people have said, that I can't be an expert and never will be and have the knowledge of Sandy and others. But with the image capture, we can capture what we have right now and allow other people to add their interpretation. So, I think you raise a good point.

DR. HABER: The notion is to do as little as possible but to be as true to the object as you can. So, in the art gallery, do you scrape the grime off the surface? That is a much more invasive approach to restoring a painting.

And I think the ethics of preservation

is to do as little as possible and prevent the object from changing to nature and physical effects.

DR. FRANCE: And that is correct. If it needs to be stabilized because the alternative is it will be completely lost, then yes, you do have to intervene but it is minimal intervention. But that is why I think the terms restoration and preservation are the two things we are juggling.

MR. STORM: A comment in the area, particularly with the art, that you just mentioned. Are you familiar with the French work that was done on the Mona Lisa where they used some kind of photo spectral analysis, where they literally tried to go back and show this is what the colors were like? All right, so that would give an impression of what people were looking at the time, as opposed to what it looks like now. Because that has been done. If you are not familiar with it, it is a wonderful project to take a look at.

And I think that is a perfect analog -- I shouldn't use that word -- yes, I should -- to what -- parallel. Thank you. That is a perfect

parallel to, I think, some of the discussions we have had in the sound field as well. One is to try to really get back to the intention of the recording engineer and the artist like that. The other one was also, and this is the concept of establishing, as was first brought out, we will call it a type 2, was yes, but how do people perceive it when it was originally done. And they are not necessarily the same thing. So, you come up with two ways of perceiving how it could be done.

So, what we were talking earlier, I know at lunch for example, if you had the plugin that said if it is played through this S and Diamond Disc phonograph, here is what those people would have heard but it is not an accurate representation of the artist. It is not at all because of the limitations of the playback equipment at the time.

So, you could have your cake and eat it too, if you want to be that crazy about it. So, you can.

The other part, too, the gentlemen, I'm sorry, didn't turn around, was taking into

consideration the artist and the performer in the field. Sound has a unique characteristic about it. Sound is not something that is on a wall and you look at, the right lighting, et cetera. Sound is an event. Sound depends on the whole environment that you are in.

So, if you are creating sound for a movie, you're a sound designer, you have a sense of the space that it is in. You have a sense that the fact that the perception is not through the ears, it is through your whole body. Because you have a sense of why home theater systems sell so well right now. Because you want your coach to rock when the low frequencies hit. And so your experience of sound is different than any other experience that you have with your senses. No other thing does that.

And so, when you are starting to put together metadata, et cetera, et cetera, I mean if you want to go to this degree you can say okay, this is a symphony. It has been done in this hall and there has been plenty of simulations of halls that have been around forever. And we know that the dB

output of this particular orchestra was 110 dB on average. So, my metadata should tell me all of that information. And if I want to experience what they intended for me to hear, which is a symphony, then I want to know that. I want to turn it up to 110 dB, et cetera. I mean you could go, if you are an audio file, you would love that stuff. I mean you want to talk about cool.

Say all right, I have got a heavy metal band. How did they want you to hear it? Well, they wanted you to close your eardrums and have them bleed.

On the other hand, to be practical about it, a lot of times, you said no, I am trying to make money. I am selling records, somebody is just going to hear it on their car radio. Somebody else is going to hear it while they are singing in the bathroom. There are so many things you have to take into account with sound that no other medium challenges you at.

And as I said, it impacts the kind of metadata. If you start thinking about how you input

sound into your body, it is crazy.

So, when you take into account the performer, what space were they in, how did they feel, you need to be sensitive to what they are doing, how they did it and get the -- it is very well documented. Vision versus sound. You watch a movie, what is the most important emotional element? It is not the picture. You can have the picture that is seven inches by seven inches with a huge sound system and it will be a big picture. That is what it does. It creates more to your motion than the image does.

The magic, of course, is, when you know how to marry the size of the image with the size of the sound and that is the maximum message. So, that is why it is a fun field.

DR. FRANCE: Comment fromn the back.

MR. NYE: As audio media preservation through imaging comes to a conclusion, thinking back on the last couple of days, two things I would like to suggest as practical next steps. Number one, I would dearly love to see something like a data

challenge and maybe along with it a coding challenge put into play through some mechanism.

And number two, thinking about the question of consensus, trying to make it more concrete. When I hear consensus, I think of consensus about what as the follow-on. And in this case, I think we maybe have in mind consensus on best practices.

So, if we reflect on what it was we heard from Jesse Johnston earlier regarding the Indiana-Harvard NEH-funded project that produced sound directions, a publication and knowing what I do know about that publication, namely, that it did not give very much scope for imaging, it is seems that we might well practically turn back to CLIR, one of the funders for this particular event, and encourage CLIR to think about an augment or an appendix to sound, or directions that would address the question of best practices, particularly for imaging.

DR. FRANCE: And just before you go, I wanted to throw a comment out to Bill Veillette. We

have been focusing on kind of standards and what the standards should be. Could you just maybe throw out some comments in terms of your clients, what they are looking for? And while we are not saying the clients know the best thing, I am just curious, just to get a perspective.

MR. VEILLETTE: Unfortunately, the answer is going to be unsatisfactory. In addition to the IRENE study, I alluded yesterday to the Mellon-funded study that we did. And in the Mellon-funded study, we surveyed people nationally and then we also had focus groups. And particularly in the focus group, one of the surprising or maybe not so surprising things we found out was that the archivists who are stewarding many of these collections, aren't particularly well-schooled in what they should be doing to either preserve the collections physically as carriers or in terms of how to evaluate proposals from different vendors when it comes time to digitize them.

So, in fact I remember one kind of highlight, or an answer, or a comment that one of

the people made when we were asking them about the issue of trust because we thought that being a nonprofit, we might have some kind of advantage there, let's say, with prospective clients because there is no pecuniary motive.

Somebody from a very sophisticated institution just kind of blurted out and then everybody else nodded in agreement that well, they have been in business. We figure if they have been in business a long time that we can trust them, if they are still in business. And everybody else nodded.

So, there is this very high degree of trust of whatever anybody tells you, until maybe you have a bad experience is the current state out there.

I will say this, that when we transitioned from microfilming to digital imaging, we had that same experience with clients in the early days. That is going away now, after they have a few projects under their belt, digital projects. And in the early days, they were very focused on the cost. They just wanted to have a consultation over

the phone. They didn't want -- they got tired of us asking them questions about simple things like what are you intending to do with these files because we need to help to find a standard to digitize these at. And so they are just very impatient. They just wanted a price.

Now, we hardly ever get that and we are finding that they are getting more sophisticated about knowing which vendors are the appropriate ones to use for certain projects. So, an example I like to use is the postcard collection. You know they could send it to a vendor that would stack the postcards in a machine and the machine will just kind of whip them through, scan them. They will produce a quite good deliverable but it might crunch say every 50th postcard. But that is okay because you can go on eBay and probably within a few months, that postcard will appear and you can just buy a new one. And you can get that postcard done for ten cents a postcard. So, why would pay NEDCC $3.50 an image to do those postcards?

But if you have the papers of Thomas

Jefferson, you are not going to send them to vendor that is going to crunch every 50th manuscript. Right?

So, they are getting more sophisticated. I don't know that they are, frankly, just going to be all that helpful. But I think that doesn't mean you shouldn't seek their input because sometimes understanding kind of their level of, you know getting a decent representation of their level of sophistication, what they are trying to accomplish is good, even if it doesn't help you set a standard.

DR. FRANCE: Well and I think that ties in nicely with the comments here that education is a critical component of what we need to do as part of it.

Bill.

MR. STORM: Yes, I think we all have different perspectives of coming at this. The work that was done by Indiana and Harvard and putting together that project served as a wonderful beginning but best practices, almost by definition,

have nothing to do with standards. It is the state of what is the best we know as opposed to what is the best that could be done. And there is a very, very big chasm between those two philosophies. And doing the best we can now, I mean it really keeps it more of a craft than a science. And the point, I hope, is to move from being a craft into something that is quantifiable and you can also judge the quality of the work that is done.

If you let it go at all right, let's keep this gentlemen's agreement, do the best you can in your place and I will do the best in mine. It is not a standard. It is not what standards stand for. It is just like here is all we could do today.

And I hope that what we are striving for is to go beyond that and to come up, as Carl said, with a set of rules. Where are the books? Where is the stuff that we could look at and we could quantifiably say if we do X, we know it lead to Y and we know that Y is where we want to be. There is a very targeted goal that you can measure and say there is an improvement or no, we are going

backwards. You don't know if you are improving on something unless you are willing to take the shots.

I mean we should be able even to go back to the traditional methodologies and say how do we know what has been done in the last 30 years in transfers and are in fact doing thousands of wrong things. Maybe there are thousands of right things. You need that metric. You need to go backwards first and get some kind of baseline and say okay, these methodologies, if you want to go by consensus or the listing test, these people's work seems to be really good but over here, how do you quantify that? It has never been quantified ever in the field.

So, I think that original document served its purpose. It made people aware of try to be objective. But there is no book. There is no rules. There is no set procedures. You can't go into one archive to another and it says all right, Bill has his thing of styli. These are the right ones to use, blah, blah, blah, here is a starting point. Where is that? It doesn't exist.

So, I wouldn't go -- I think that is going

backwards. I think it is wonderful it was done but I think you need it to move forward. And if you can get an initiative that works on methodologies that are quantifiable, that could have metrics all along the way, to say this is good, that is bad, not because I think so. Right now it is all because I think so. No, let's show the science behind it, rather than say science doesn't belong in this field. I think it does.

DR. FRANCE: In the back.

MR. NYE: I focused on consensus that is best practices but should have said that it is with the understanding that standards and best practices often and most successfully go together. That is, best practices often include footnotes and references to the sort of standards that need to be brought into play.

So, I don't see them as separable. But your point is well taken that it would be unfortunate to go backwards to what was a document that was written two or three years ago without reassessing it critically. But again, I think that both

standards and best practices can productively go forward simultaneously.

DR. FRANCE: Great. So, I am going to just, some of the recurring things I am hearing here is that we need to loop the knowledge and information of the materiality of the materials to really move things forward. And this has to be based on underlying science and metrics that some of us want to go big. And we think we should go big and we should just be bold and go out there.

Data sharing and the management of the data seems to be another component. How can we actually link share the data more effectively? And while we know we can't let the IP issue go away, how do we at least start to get that out there so that some of the big organizations like Gene was talking about with SONY, and others might come onboard with some of that.

Looking to other fields to see what they had been doing in terms of quantification and metrics, do we want to come out of this people to actually put their names forward one or two specific

working groups to say in six months' time we want to do this and we will report on having done this. And I am very aware and I am sure we are all aware that we are all completely overloaded and doing five times more than we possibly can but we do it anyway because we love what we are doing. But when you are given a deadline, when you have to do something, it is amazing what you do the night before. And so I'm thinking five months and 29 days, we won't be really busy.

So, I want to throw that out there and make that something that gets sent out by the organizers to see what are the one or two key things that we could do for the next six months, the next year, while we start to say how do we move forward with the big picture. Is it Carl and others saying well, here is what we are currently saying is our current standards. What we think should be there is the core required fields. What else really needs to be there to better do this catch?

Thoughts from the audience?

PARTICIPANT: Well, I proposed the

courses before.

DR. FRANCE: Yes, I'm sorry. I forgot. I was writing it down and I didn't say it.

PARTICIPANT: And the woman in front of me suggested a journal or a newsletter, or at least the numbers counting people did that. And I think some communication like that which is fairly regular would serve to tie the group together and produce a common language, some commonality and that is not very expensive.

My personal feeling is it is a little early for standards to be set, except for software or software hooks, so that modules could speak to each other or Cornell could expand upon this.

But as far as technical standards beyond that, I don't know. I think the field technically is still developing. But education, newsletter, another meeting scheduled in nine months or twelve months. These things are cheap and not too difficult, I think.

DR. FRANCE: Another thing just going back to Carlene and some of the press releases that

have come out, there is so much interest in this. And that is probably something that we are not leveraging a lot either. We are not -- I know at the library you are not particularly good at promoting ourselves. I don't know that about other people but it is something, I think, could be focused on, too, as a non-cost tool.

So, I am sure after we will probably check who is willing to share their emails and then that can be sent out.

DR. HABER: I mean responding also, I mean I would be really happy to see more stuff about these technologies written down in some draft and growing document that somehow becomes, I don't know, a bible or a basic text that underlies these discussions. Because if we can get all the ideas in one place and then get people's reactions, we can hone in on what it is that are the sticking points, what people understand, what they don't understand.

Obviously, we span many communities with different experiences but I think it can almost all of it can be put into form that pretty much

everyone can embrace. That is what I think.

DR. FRANCE: And there's so much now with something like a wiki platform that could be hosted somewhere and it could become not necessarily open but for this group to share those thoughts and comments.

Peter, you had some comments?

MR. ALYEA: Since Carl had laid out his vision for how you might quantify these things, maybe the documentation for our system could be a template and then that could be then passed to legacy audio devices and the way, since Sandy has issues with almost all digital devices. That is correct, Sandy?

Yes, so I mean when you have really hard -- when you have somewhat an expert like that, then looking at he then could then look at this template and say where is it weak and where it doesn't answer those questions.

DR. FRANCE: We embrace it anyway.

DR. HABER: Frankly, I think also like a really key thing for all of this is to use the

technology as much as possible and get experience with it on larger and larger projects because I don't know, maybe we will do them wrong at first or make the wrong guesses. But unless we generate a date -- and that is why I am so happy. For example, NEDCC is using the machine. I have great optimism that we will get the cable soldered downstairs today and get you back online. The cable is broken -- fixed, I think.

Anyway, and I am extremely excited about the UC Berkeley project because it is so focused on such a singular target. I think that is going to teach us a lot.

So, I think that those projects, which are now basically they are on their ballistic, which means they have taken off and they are going to fall under gravity.

DR. FRANCE: And I think also that the data and coding challenge is a really interesting inexpensive way of doing this. Some colleagues of mine, in terms of the Archimedes Palimpsest, one of the things at one point was literally putting the

data sets out there and inviting people to look at different ways of doing imaging. And this could be, a specific data set could be put out there, particularly to students, just to see some component.

DR. HABER: This is speaking to the data challenge.

DR. FRANCE: Well, I would like to take this opportunity to say an incredible thanks to the organizing committee, Adrija, Peter, Carl, and I am going to leave a hundred other people off here. But if you would just join me in thanking them because I know I have been involved in some of the discussions, they were having weekly meetings. Just the time involved with the thought put into structuring and putting together decisions and bringing you altogether has just been incredible. And I think you will agree with me that this really has been an incredible two days and it has really stimulated a lot of thought. It has brought together so many different experts and I hope it is just the first of many. So, thank you so much.

Adrija, did you want to say anything to wrap-up?

MS. HENLEY: First of all, the organizers of the Library -- this is the first that we organized. And there are suggestions that we maybe can do another one. So, we will see.

I thank everybody for getting here from all over the world. Really, it was stimulating discussion. I think it will be on the web. Fenella, do you think it takes about a month?

DR. FRANCE: It probably would take at least a month but I am sure Adrija can send a note out when the link is live. Sometimes it takes a little bit longer with the ADA compliance.

MS. HENLEY: Yes, so we will have it all available. Thank you again for arriving here and joining us.

DR. FRANCE: And thank you to all the presenters.

(Whereupon, the above-entitled matter went off the record at 4:56 p.m.)