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# BEST PRACTICES EXCHANGE

## Milt Shefter

# About the Academy



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# THE DATA EXPLOSION



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- GOOGLE processes > 24 PB/ day  
1 Petabyte =  $10^{15}$  bytes

1,000 times all printed materials  
In Library of Congress

3 billion requests daily

# THE DATA EXPLOSION (CONT.)



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- FACEBOOK –

10 million photos uploaded every hour

# THE DATA EXPLOSION (CONT.)



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- TWITTER –

Messages grow 200% each year

# THE DATA EXPLOSION (CONT.)



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- In 2000, 25% of world's information stored digitally
- TODAY –
  - Less than 2% stored NON-digitally

# THE DATA EXPLOSION (CONT.)



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- Volume of digital data
  - doubles every three years

# THE DATA EXPLOSION (CONT.)



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- 3<sup>RD</sup> Century B.C.
  - Library of Alexandria houses sum of human knowledge

TODAY – all have access to 320 times that information



# THE DATA EXPLOSION (CONT.)



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- Information overload?

# Academy Mission



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- To advance the art and sciences of motion pictures
- To recognize outstanding achievements
- To provide a common forum and meeting ground for branches and crafts
- To represent the viewpoint of the actual creators of the motion picture
- The Academy is about the *arts & sciences*, not the business

# Academy Activities



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- The Oscars
- Public programming
- Gallery exhibitions
- Margaret Herrick Library
- Academy Film Archive
- Educational initiatives
- Grants, screenwriting competition

# Academy Facilities



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Beverly Hills, CA



Beverly Hills, CA



Hollywood, CA

# Inside the Academy



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# Academy holdings



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- Library:
  - 35,000 books and periodicals about cinema
  - 35,000 movie posters
  - 10,000 scripts
  - 1,000 special collections
  - 10 million photographs



- Film Archive
  - 70,000 titles
  - 140,000 items including trailers and home movies
  - Film, videotape and digital media
- 3 dimensional objects
  - Cameras
  - Projectors
  - Props – including the Ruby Slippers

# Coming soon: The Academy Museum of Motion Pictures



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# Digital Technology Changes Everything



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- 1980s: digital visual effects
- 1990s digital sound
- 2000s: digital projection
- 2010s: digital motion picture cameras
- And now, diminished supply of celluloid film

2003



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ACADEMY OF MOTION PICTURE ARTS AND SCIENCES

# The Science and Technology Council Today



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- The Council: 25 Academy members
- Three focus areas:
  - Technology History
  - Public Programs and Education
  - Technology and Research Initiatives
- Staff + consultants + interns
- Over 300 volunteer scientists, technologists, practitioners and artists
- Please visit [www.oscars.org/council](http://www.oscars.org/council)

# Technology History



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- The art form is enabled and advanced by technology
- Preservation of the history of the technology is as important as preservation of the art
- The lessons of the past inform choices made about new technology
- The Academy is the only cultural institution that concerns itself with ALL motion picture technology

# Public Programs & Education



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- 12-16 live events each year in the U.S. and abroad
  - Recently: International Broadcasting Convention (Amsterdam), Korea and Brazil, and now, India
- Council Internship Program: developing the next generation of motion picture technologists

# Technology and Research Initiatives



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- Important, unsolved problems facing the industry
- The Academy provides a neutral forum with the resources and expertise for appropriate projects – no other organization like it exists
- The Academy has a unique ability to engage studios, technology and service providers and research institutions

# Technology and Research Initiatives: objectives



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- Establish motion picture industry requirements and best practices
- Collaborative problem-solving
- Research: investigations and explorations
- Goal: enable Excellence, solve some problems, feed the standards process, discovery in service of enhancing the art form

# Early Academy-driven standards



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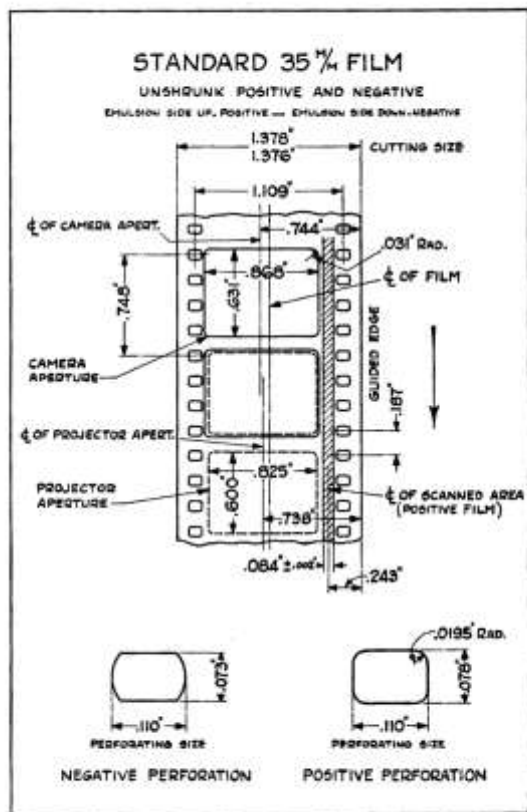


FIG. 3. Layout of 35-mm. sound film and apertures.

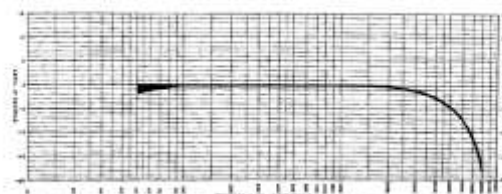


FIG. 1. Revised Standard Electrical Characteristic for two-way reproducing systems using metal diaphragms; Types I (M-101, M-1, M-2 Systems), II, and III. For optimum results with current studio sound recordings Type I, II, and III Systems equipped with metal diaphragm speakers should be adjusted to this Revised Standard Electrical Characteristic.

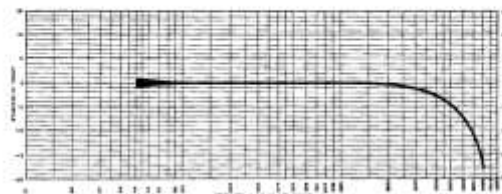


FIG. 2. Standard Electrical Characteristic for two-way reproducing systems using metal diaphragms; Type I (M-3 Systems). This characteristic for Type I equipments (M-3 Systems) has not been changed, and remains as specified in the original publication of March 31, 1937, and the subsequent publication of June 8, 1937.

Electrical Runs, Measured at the Output of the Power Amplifier with a Resistance Equivalent to the Speaker Load Using the Academy Research Council Standard Multi-Frequency Test Reel (Corrected), Altec Test Film (ED-20, Corrected), or RCA Test Film (Catalogue No. 26571)

The tolerances of  $\pm 1$  db. up to 3000 cycles, increasing progressively with frequency to a maximum of  $\pm 2$  db. at 7000 cycles, should be rigidly maintained in adjusting equipment to these specifications.

Electrical Runs, Measured at the Output of the Power Amplifier with a Resistance Equivalent to the Speaker Load Using the Academy Research Council Standard Multi-Frequency Test Reel (Corrected), Altec Test Film (ED-20, Corrected), or RCA Test Film (Catalogue No. 26571)

The tolerances of  $\pm 1$  db. up to 3000 cycles, increasing progressively with frequency to a maximum of  $\pm 2$  db. at 7000 cycles, should be rigidly maintained in adjusting equipment to these specifications.

ACADEMY SPECIFICATIONS FOR 35MM. MOTION PICTURE RELEASE PRINTS

**PROTECTIVE LEADER**  
Will be transparent or raw stock.  
When the protective leader has been reduced to a length of four feet it is to be retained to a length of six feet.

**IDENTIFICATION LEADER (Part Title)**  
Shall contain not less than 32 frames in each of which is plainly printed in black letters on white background, type of print (see nomenclature), part number (arabic numeral not less than 1/2 of frame height), and picture title.

**SYNCHRONIZING LEADER**  
First section shall be opaque.  
Start mark shall be one frame in which is plainly printed in black letters on white background 1/2 of frame height.  
A white line 1/2 inch wide upon which is superimposed a diamond 1/2 inch high by 1/2 inch wide shall be printed across the picture and sound track area at a point exactly 20 frames ahead of the center of the start frame.  
Beginning 5 ft. from the first frame of picture, each foot is to be plainly marked by a transparent frame containing an inverted black numeral at least 1/2 frame height. Footage indicator numerals shall run consecutively from 1 to 11, inclusive.  
This section shall be opaque and contain frame lines throughout entire length which do not cross sound track area.  
At a point exactly 20 frames ahead of the center of each footage numeral frame there shall be a diamond (white on black background) 1/2 inch high by 1/2 inch wide.

**PICTURE**  
It is recommended that picture action start and finish on fades whenever possible, otherwise significant sound should be kept at least five feet from the start and finish of the picture.

**MOTOR CUE**  
Shall be circular opaque marks with transparent outline printed from the negative which has had four consecutive frames perforated with a serrated edge the 0.094 inch in diameter. The center of these holes is to be halfway between the top and second sprocket hole 0.281 inch from the right-hand edge of the film with back up and emulsion toward the observer.

**CHANGE-OVER CUE**  
Shall be same as motor cue.

**RUNOUT TRAILER**  
Shall be opaque.

**IDENTIFICATION TRAILER (End-of-Part Title)**  
Shall contain not less than 32 frames in each of which is plainly printed in black letters on white background. End of part, part number (arabic numeral not less than 1/2 of frame height), and picture title.

**PROTECTIVE TRAILER**  
None as protective leader.



# Academy Film Leader - 1950



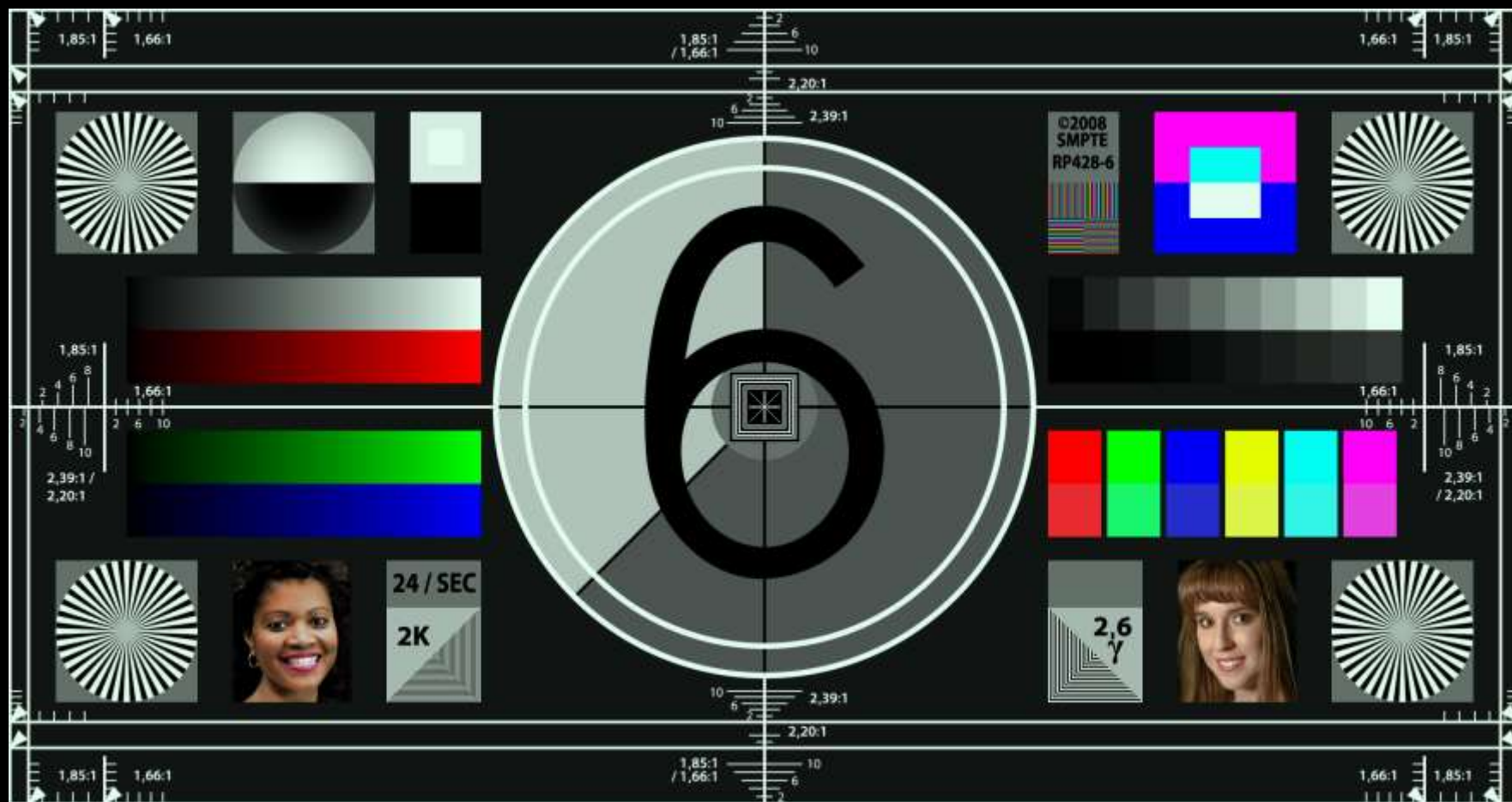
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# Academy Digital Leader - 2009



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## SMPTE RP428-6:2009 Digital Leader

# The Motion Picture Industry is changing



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- Film is 100 year-old technology
  - Benefit: long-term guaranteed access
- Digital technologies bring many benefits:
  - Better sound quality
  - Visual effects and animation not possible with film
  - Digital mastering
  - Digital cinematography
- But, “you don’t get something for nothing...”

# Large digital files present challenges



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- More than 50 Megabytes per frame (and 24 frames are produced every second)
- More than 8 Terabytes per master version of a two hour movie (and there can be 40 or more different masters)
- More than 2 Petabytes for an entire digital movie production

# 2005 Academy Digital Motion Picture Archival Summit



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- Major Hollywood Studios, Film Archives and Academy met to discuss the issues of digital technologies for motion pictures:
  - Digital does not always get “cheaper”
  - The Motion Picture Industry is not a prime market for storage vendors
  - Digital archiving is not traditional “archiving”
  - Film will probably not be available forever

# Is this a “problem” or a “dilemma”?



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- **Problem:** a thing that is difficult to achieve or accomplish
- **Dilemma:** a situation in which a difficult choice must be made between undesirable alternatives

# *The Digital Dilemma*



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Download the report here:



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[Oscars.org/tdd](http://Oscars.org/tdd)



# What do we mean by “archiving”?



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- **Archives and Libraries** are not the same thing
- **Archive:**
  - Preservation without errors; access without end
  - Access model: WORSE (**W**rite **O**nce, **R**ead **S**eldom if **E**ver)
- **Library:**
  - Temporary storage site
  - Access model: online or near-line

# Why does the Motion Picture Industry archive?



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- There is significant, long-term value in movie content
- Movies are also part of the cultural record

# Current technologies and practice are inadequate for motion pictures (and others)



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- SNIA 2007 Report: “Migration is Broken”

## 100 Year Archive Requirements Survey

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### The Petabyte Problem

Migration is broken. Migration practices do not scale to meet the digital preservation requirements of the data center.

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future applications or readers without losing the authenticity of the original. Physical migration means to copy the information to newer storage media to preserve the ability to access it and to protect it from media corruption. Best practices today require logical and physical migration every 3-5 years. Based on these practice standards, the real underlying challenge is how to scale migration capabilities while controlling cost. An organization that has 1,000 TB (a petabyte, PB) in its digital archive repository will have 50% more next year. In three years, they will need to migrate that first petabyte. In five years they will need to migrate 2.25 PB. How do organizations expect to do that and keep up with the growth, the cost, and the complexity? The answer is they can not. They will not<sup>2</sup>. It is the contention of the 100 Year Archive Task Force that migration as a discrete long-term preservation methodology is broken in the data center. Today's migration practices do not scale cost-effectively and won't be done until a crisis erupts. This means that today's reliance on migration is taking us down a 'dead-end path'. Hear this clearly. Under these practice guidelines, the world's digital information is at great risk! New technological approaches are required that meet the legal, business, cost, and scalability requirements of the 'digital age' for long-term digital information retention.

# The Digital Dilemma



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- Today's digital systems – no guaranteed long-term access
- Preservation without access is useless

# Long-term access



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- Analog film system – Proven 100-year life
- U.S. copyright – at least 95 years



- Not perfect:
  - Nitrate base – self ignition potential
  - Acetate base – “vinegar syndrome”
  - Eastman Color – fading
- But we know it lasts 100 years or longer when properly processed and stored

# An eloquent statement about film



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“Film has captured us in an unparalleled manner that must not be forfeited for the sake of technological advances and economic gain.”

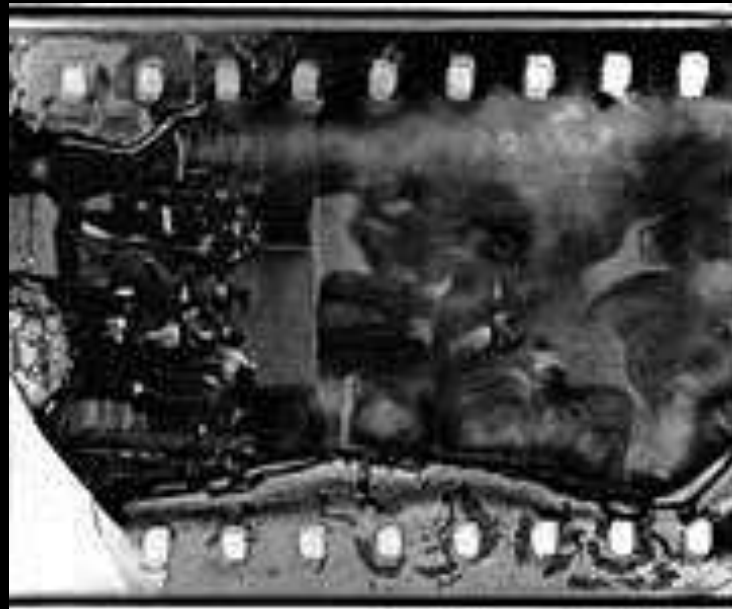
\*Cinematographer Guillermo Navarro

If nothing changes....



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This could be a period of “Digital Nitrate”





# Do other sectors have a dilemma?



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- Corporate
- U.S. Government
- Medical
- Earth Science
- Supercomputing

# Two major findings



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- Similar problems and issues with digital preservation
- No long-term strategy or solution that does not require significant and ongoing capital investment and operational expense

# Requirements for Digital Motion Picture Archiving



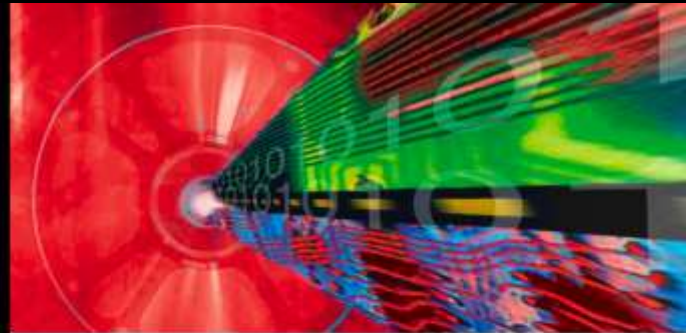
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- Access guaranteed for at least 100 years
- Assets survive periods of benign neglect
- The digital system should be at least as good as the photochemical system it replaces

# A second report: released January 2012



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## THE DIGITAL DILEMMA 2

Perspectives from Independent Filmmakers, Documentarians and Nonprofit Audiovisual Archives



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THE ACADEMY  
OF MOTION PICTURE ARTS AND SCIENCES

# *The Digital Dilemma 2*



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- Focus on perspective from:
  - Independent filmmakers
  - Documentarians
  - Public, nonprofit audiovisual archives

# Metrics



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- In 2010:
  - 706 films released and screened in the U.S.
  - Hollywood majors – 174 features
  - Indies – 532 features
    - 75% of total

# Archive vs. Library



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- **Archive** – master-level content
  - long-term access
- **Library** – temporary site
  - circulating duplicated holdings

# Long-term objective



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- Preservation goal: 95 years or longer
  - The term “Digital Preservation” does not agree with this goal
  - Better term: “Preservation of Digital Materials”



# U.S. National Recording and Preservation Board study



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- Digital technology alone will not insure preservation and survival
- Digital technologies link preservation and access
- Analog recordings made more than 100 years ago are more likely to survive than today's digital recordings
- Born-digital audio is at greater risk of loss than 78 RPM discs

# Current challenges



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- Lack of funding
- Lack of trained staff
- Lack of technical standards
- Whose problem is this?
- Who will solve it?

# A review: *TDD* near-term steps



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- “Create film separation masters as archival masters”
  - Hollywood Studios: Check!
  - Indies/Nonprofits: too costly
- “Develop a rational strategy for preservation of digital materials”
  - Studios: working on it
  - Indies: insufficient awareness
  - Nonprofits: resource constrained

# TDD near-term steps - 2



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- “The Industry must work together”
  - Hollywood Studios, equipment and service providers, Academy are doing this: for example: ACES, IMF, and EIDR
    - you can “Google” these acronyms for more information
  - Indies/Nonprofits: loosely coupled ecosystem inhibits meaningful collaboration

# TDD long-term initiatives



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- “Collaborations”
  - Hollywood Studios, manufacturers, service providers, Academy: working on it (ACES and IMF)
  - Indies: no activity
  - Nonprofits: AMIA/FIAF/IASA committees, U. S. National Digital Stewardship Alliance: but are these enough?

# TDD long-term initiatives – cont'd



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- “Standards development”
  - Studios: working on it (ACES and IMF), metadata=hard!
  - Indies: no activity
  - Nonprofits: FADGI/AMWA work, IASA TC-06 (coming soon, but what about accredited Standards Development Organizations?)

# So – now what?



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- Collaborations are crucial
  - Cooperatives and resource sharing
  - Research and prototyping projects
  - Revenue sharing between content creators and archives
  - Lower-cost approaches: open source software and p2p networks

# A major concern



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- Funding
  - This is a problem
  - U.S. Blue Ribbon Task Force Report: solid thinking on how to develop economic models to support preservation
  - Collaborate, collaborate, collaborate



# Looking toward the future



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- Education

- Train the next generation of audiovisual archivists: make them “digital natives”
- Raise awareness in the independent filmmaking community – YOU are stakeholders, too

# Technology Obsolescence



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- New technology brings new benefits, but has one major drawback: 5-7 year lifetime
- Results in:
  - Expensive and error-prone preservation
  - Lack of accessibility (obsolete data and equipment)
- The LTO tape scenario:
  - Manufacturers say “30-year lifetime” for LTO tape
  - Does anyone here use 30 year-old storage technology?



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Time is our greatest enemy

# Key questions



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- Whose responsibility?
- What is the economic and cultural impact of losing these works?
- What will it take to achieve universal adoption of digital preservation standards?
- Who will take the leadership role?

# What can we do?



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- The Digital Dilemma is a universal dilemma
  - It affects all sectors using digital storage technologies
- Today's digital storage technologies
  - Not economically viable for long-term preservation
- Act now to solve The Digital Dilemma while important digital collections are relatively young and few in number



“We can’t solve problems by using  
the same kind of thinking we used  
when we created them”\*

\*Albert Einstein

GOAL



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MAKE TECHNOLOGICAL OBSOLESCENCE

OBSOLETE!

Future



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# “The Digital Solution”