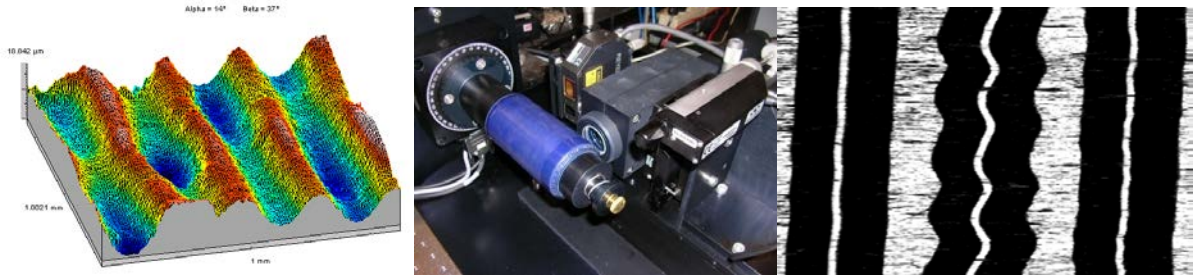
Imaging Historical Voices: New Optical Methods for the Preservation of Recorded Sound

A significant challenge to the preservation and restoration of historically valuable sound recordings is finding methods to access the content safely and accurately. In recent years considerable progress has been made in the research and development of non-contact optical methods to restore, preserve, and create digital access to mechanical sound carriers. The basic idea is to create a digital representation (image) of the sound carrier surface and then extract the audio content by modeling the stylus motion on a computer. In 2004-2006, the "IRENE" project, funded by NEH, resulted in a system to scan disc records using digital microphotography in two dimensions. In 2007-2012, the "3D/PRISM" and later projects, funded mainly by IMLS, focused on the extension of the IRENE approach to three dimensional imaging of cylinders and discs using confocal microscopy. (See figure below, of a scanner, and images). These systems output standard audio, image, and data file formats supported by libraries and archives.

The research project has addressed a variety of collaborative studies to advance this technology further, build sustainability into its design, and make it available and relevant to collections of diverse character and location, nationally and internationally. The technology is developed at Lawrence Berkeley National Laboratory, in Berkeley, California (URL http://irene.lbl.gov/, contact: chhaber@lbl.gov). The Library of Congress has been a long term partner and has guided many aspects of the development. Additional partners include the Northeast Document Conservation Center (www.NEDCC.org), The Phoebe Hearst Museum of Anthropology, The University of Chicago South Asia Library, The Smithsonian Institution, the Edison National Historic Site, and the University of Applied Science, Fribourg, Switzerland.



The project addresses the needs of libraries, museums, and archives, holding collections of mechanical sound carriers and their stakeholders. The non-contact playback technology is relevant to legacy formats which may be at risk for damage and degradation. Collections of scale which require mass digitization benefit from the automation of data collection and analysis strategies. Aspects of the research include,

- Archive workflow: Scanning systems have been installed at the Library of Congress and at NEDCC, for use as a production tool. NEDCC is now offering this tool as a service to its customers.
- Remote operations: A "portable" 2D system has been built for the Univ. of Chicago and installed at the Roja Muthiah Library, Chennai, India, for use with early 20th century record collections.
- A 3D digitization pilot study of wax ethnographic fieldwork cylinders has been completed.
- Audio extracted from diverse formats: shellac, acetate, wax, aluminum, cellulose, Berliner discs.
- A copper "galvano" cylinder mold from the Berlin Phonogramm Archive has been digitized.
- Many early experimental recordings from the mid-to-late 19th century have been restored. "Hear My Voice: Experimental Sounds from Alexander Graham Bell's Volta Laboratory" a 2015 Smithsonian exhibit, will feature a variety of recordings restored with this technology.
- Tools for the virtual reassembly of broken carriers have been created, including a complete measurement of the Dickson Cylinder, Thomas Edison's 1893 attempt to synchronize film and audio.

From the left (a) Depth image of wax cylinder showing damage to surface (~1910). (b) Experimental recording, wax on paper, Smithsonian (A.G. Bell, early 1880's) (c) Copper cylinder "galvano" mold (early 20th century). (d) Example of a broken disc which was reconstructed with IRENE.