EXHIBIT C

TO THE AP'S MOTION IN LIMINE NO. 5 TO PRECLUDE OBEY CLOTHING FROM PRESENTING SHEPARD FAIREY'S EXPERT WITNESSES AT TRIAL

An Investigation of the Techniques Employed by Shepard Fairey to produce the Obama Hope and Progress Posters

Prepared by

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October 1, 2010

I. Assignment

1. I have been asked to determine what can be inferred from the documentary record in this case concerning the manner in which the image contained in the Hope poster was created by Shepard Fairey.

II. Qualifications

2. I came to Rochester Institute of Technology (RIT) in 1981 as a graduate student in the School of Printing. I had been working for several years prior to my arrival as a writer and event photographer for various non-profit organizations. My initial reason for coming to RIT was to gain technical knowledge of the processes by which photographs and written texts were reproduced in printed form. In the fall of 1982 I was invited to join the faculty to teach a technical course in printing plates that involved photo-mechanical techniques for creating the plates (tooling) for all major processes, including offset lithography, gravure, flexography and screen printing.

3. During the 1980s, digital technologies for the preparation of original artwork began to be introduced, and I completed an M.S. degree in computer science with the long-term goal of developing a new curriculum for the School. In the late 1980s I became program coordinator for a new undergraduate program in Printing and Applied Computer Science. Since then my teaching and research have kept me at the leading edge of technology relevant to the reproduction and distribution of graphics, with special emphasis on the reproduction of artwork and photographic images. In 1997 Delmar Thomson Learning published my book, *The Pocket Guide to Digital Printing*, which went through seven printings and was distributed throughout the world. The book was republished in a Chinese language edition in 1999. In 2001 RIT launched The Sloan Printing industry Center with funding from the Alfred P. Sloan Foundation and sixteen corporate partners. I led the effort to create the Center with a group of colleagues from the RIT Saunders College of Business and the College of Imaging Arts & Sciences. I served as co-director of the Center from 2001 until 2009. In 2005, the RIT

Cary Graphic Arts Press in partnership with the RIT Sloan Printing Industry Center published my book, *The New Medium of Print: Material Communication in the Internet Age*. In 1997 I was appointed associate dean of the College of Imaging Arts & Sciences, and in March 2009 was appointed interim dean of the College. A copy of my c.v. is attached as Exhibit A to this report.

4. My current research focuses on the impact of digital technology and digital culture on traditional forms of creative expression, with a special focus on the illustrated book. The College of Imaging Arts & Sciences offers undergraduate and graduate programs in six schools, including Art, Design, Craft, Photography, Film and Animation, and Print. As a professor, researcher, and administrator in the College of Imaging Arts & Sciences, I have gained an intimate knowledge of every aspect of image creation and reproduction, both current and historical processes. I have a complete understanding of the known possibilities for the production of photography such as the work by Mannie Garcia and artwork such as the work by Shepard Fairey.

III. Evidence Considered

5. Shepard Fairey's counsel provided me with the following digital documents and physical objects during the course of my investigation:

a. Two letter-sized color laser prints, one of the original Mannie Garcia photograph and one of the Fairey Hope poster.

b. A digital image file (APDCMG1265.jpg) of the original Mannie Garcia photograph of Barack Obama in its original form.

c. A digital image file (DCMG134.jpg) of a slightly modified version of the original Manuel Garcia photograph of Barack Obama. I was informed by Fairey's counsel that this version of the image was the one that Garcia submitted to the Associated Press.

d. A digital image file (fairey104758.jpg) of a photographic image of Barack Obama in grayscale with the background removed. I was informed by Fairey's counsel that this was the earliest version of the image that was saved by Shepard Fairey after he downloaded the image from the Internet.

e. Six digital image files (fairey104739.tif, fairey104740.tif, fairey104741.tif, fairey104742.tif, fairey104743.tif, and fairey104744.tif) that I was informed by Fairey's counsel were derived by Shepard Fairey from fairey104758.jpg. I verified that these six files were indeed derived from fairey104758.jpg by applying a binary threshold filter (specifically, in Photoshop using the Image>Adjustments>threshold function and setting the threshold value manually) to separate the image into regions of pure black and pure white with no intermediate gray tones. I was able in this fashion to replicate the six ".tif" files. The differences among the six images are attributed to the varying gray value selected for the threshold between black and white.

f. The Adobe Illustrator file (BARACK screen POSTER.ai) of the final "Progress" poster.

g. The same image file in Adobe PDF format.

h. Final printed versions of the offset lithographic printed "Hope" poster and the screen printed "Progress" poster.

i. A digital image file (obama.jpg) containing a scanned image of artwork that was constructed by Shepard Fairey using two original rubylith layers that he produced in the course of creating his "Hope" artwork.

j. The deposition transcripts of Shepard Fairey, Mannie Garcia, Michael Raynor, and Daniel Navar, and a CD containing exhibits from the depositions taken in the case.

IV. Analysis

A. The First Saved Image

6. I began my investigation by reviewing a file named fairey104758.jpg, which was provided to me by Fairey's counsel. I was informed that fairey104758.jpg was the earliest image file that Fairey saved after downloading a version of the Garcia photograph of Barack Obama from the Internet.

7. The first saved file (fairey104758.JPG) measures 1215 pixels wide by 1557 pixels high. The image is in grayscale color space, meaning that each pixel is represented by a single byte of data representing luminosity and containing no color information.

8. Several observations about this image file are relevant. First, the background image information behind the figure of Obama has been erased. The pixel values in the background are all byte value 255, or pure white. The boundary edge of the erased background is hard, meaning that the transition from original image pixels to erased

pixels is abrupt. This means that the background pixels were removed from the image at precisely its current pixel resolution. Another way of saying this is that the image was not increased in size after the background was removed. There are two common methods for removing the background in the Adobe image-editing program, Photoshop. The first method is to use the eraser tool. As the eraser tool is dragged across the image, all of the pixels underneath the eraser are converted to a specific pixel value (which in this case would have been 255), in effect "erasing" them. The second method is to use the lasso tool to delineate and select the background and then use the delete key to "delete" the selected material. As with the eraser tool, "deletion" means that the pixel value of all of the pixels within the selected area would be reset – in this case to 255. The second method commonly has the effect of leaving some residual background along the edges of the image as shown in Figure 1. Of the two methods, it is clear from the image that Fairey chose to use the latter method. If he had used the eraser, he would not have left some unerased pixels along the right, top, and left edges of the frame.

Figure 1. Unerased image pixels along the top and right edge of the frame are clear evidence that the background was removed using the Photoshop lasso tool, and not the eraser tool.

9. The image shows clear evidence that it has been resized from a much smaller original. The approximate size of the original can be determined by an analysis of image artifacts in the area of Obama's jacket, as shown in Figure 2.

Figure 2. JPEG artifacts evident in some areas in fairey104758.JPG.

10. These artifacts are in the form of square tiles that can clearly be seen in the jacket. Each of these square tiles is composed of approximately 33 pixels wide by 33 pixels high. These squares are the evidence that the pixel information in the jacket portion of the original image was highly compressed using a JPEG compression algorithm, but that the original image was much smaller than fairey104758.JPG. This is because JPEG compression divides an image into 8 by 8 pixel blocks, and then applies compression to each block independently. At a high compression setting, this creates a characteristic tiling artifact of the image that can be seen if enlarged. Since the tiling artifacts in fairey104758.JPG are in 33 by 33 pixel blocks, each block has been enlarged by a linear factor of 33/8 = 4.125. Using this factor, it can be determined that the original image that was used to create fairey104758.JPG was smaller in both horizontal and vertical pixel dimensions by a factor of 4.125. Thus the original size of fairey104758.JPG prior to enlargement was approximately 295 pixels wide by 378 pixels high.

11. Counsel informed me that the file name under which Fairey originally saved fairey104758.JPG was image_3655004.jpg. This naturally suggests that the fairey104758.JPG was derived from a version of the photograph of Obama taken by Mannie Garcia that bore the file name image_3655004.jpg. To test this hypothesis, I first ascertained whether any copies of image_3655004.jpg could currently be found on the Internet. I found several sites hosting the image. They include: http://farrington1600.wikispaces.com/2bluenews, http://kochiranewyork.seesaa.net/category/2308023-1.html, and

http://s303.photobucket.com/albums/nn145/sashai85/?action=view&current=image_3655004.jpg&newest=1. None of the versions of image_3655004.jpg that I found contains any metadata identifying the provenance or ownership of the image. Image_3655004.jpg measures 300 by 450 pixels. If we take the image and crop it as close as possible to the framing of fairey104758.JPG, the cropped dimensions are 291 pixels wide by 374 pixels pixels high. This is almost the same as the calculated original size of fairey104758.JPG.

12. If we now take the cropped version of image_3655004.jpg and convert it to grayscale and then enlarge it by a linear factor of 4.125, the resulting image can be visually compared to fairey104758.JPG. The results of this comparison are shown below.

Figure 3. fairey104758 right eye detail.

Figure 4. image_3655004 right eye detail.

13. The appearances of these two images (Figures 3 and 4) are almost identical. Both images show clear evidence of having been enlarged from a much smaller original using Photoshop bicubic interpolation. Both images show the evidence of the original JPEG compression enlarged by approximately 4.125 times.

14. There is clear evidence in fairey104758 that Obama's left eye has been lightened using the Photoshop dodging tool. This can be seen in the comparison below.

Figure 5. image_3655004.jpg after mode change and enlargement.

Figure 6. fairey104758.jpg. Note lightening of Obama's left eye.

15. There is no doubt that the image information in the file that Fairey first downloaded and then manipulated to produce fairey104758.jpg was identical to or extremely close to the image information in image_3655004.jpg. The slight differences between fairey104758.jpg and the results of altering image_3655004.jpg by changing the mode and enlarging it by a linear factor of 4.125 can easily be attributed to the likelihood that Fairey obtained the image from one of several sites that may have featured versions of the same image at the time he went looking for it. It is not uncommon practice for the owner of a website wishing to display a version of an image found on another site to resize and compress the image to fit the specific needs of his site. The size of image_3655004.jpg is compatible with basic visual requirements for display on a web page, so it is likely that the version of the image that Fairey originally downloaded was approximately the same size. The evidence strongly suggests that Fairey found a version of the image on a website that had been processed to reduce the size of the file to a minimum using software that was capable of varying the compression in different parts of the image. This would account for the more visible evidence of JPEG artifacts (square tiles) in the jacket than in the face. It is likely that Fairey found the image on a blog or news site that obtained the original image and then resized and compressed it.

16. The evidence is equally strong that fairey104758.jpg did not come from file DCMG134.jpg – the high resolution version of the original photograph that Garcia provided to the Associated Press. This can be seen by comparing the following crops from the two images:

Figure 7. fairey104758.jpg (above) compared to full resolution original of the Garcia photograph (below).

Note the difference in clarity between the two images. This is because the original Garcia image below contains much more image information than fairey104758.jpg.

17. What is absolutely clear from this analysis of fairey104758.jpg, and the comparison to the original image, is that Fairey did not start with the high-resolution version of the image. The differences between the image Fairey used and the original Garcia image are clearly visible in Figure 7. The original image contains much more information than fairey104758.jpg. Individual hairs in the eyebrows and eyelashes that are clearly visible in the original are not visible in fairey104758.jpg.

B. The Bitmaps

18. Fairey produced six additional image files. These are fairey104739.tif, fairey104740.tif, fairey104741.tif, fairey104742.tif, fairey104743.tif, and fairey104744.tif. Fairey produced these files by applying a binary threshold filter to fairey104758.jpg and setting the threshold at different values. This filter renders all pixel values below the threshold as black and all pixel values at or above the threshold as white. If the threshold is set to a darker pixel value, fewer of the pixels in the image will be rendered as black and more will be rendered as white. So by setting the threshold at different values, the boundaries between black and white can be altered. The visual effect is to create images composed of only two pixel values, black or white. These six images were most likely used as rough guides for the creation of the outlines in the final poster.

C. The Creation and Use of the Rubyliths

19. To understand the next stage in Fairey's creative process, it is useful to have some background. *Screen printing* is a process that employs stencils supported on a fabric or wire mesh screen stretched tight over a rectangular frame. The stencils are created by coating the screen with a light-sensitive material that polymerizes when exposed to light of selective wavelengths. The simplest way to make a screen stencil is to mask areas that correspond to where the ink will be transferred to the printed surface with a material that blocks the transmission of active light. The traditional material used for this purpose is called Rubylith.

20. *Rubylith* consists of a thin layer of translucent red film supported on a thicker layer of clear plastic. The material is designed such that intricate patterns can be cut out of the colored layer with an Exacto knife and removed from the clear base. To make a film stencil for a screen that would be used to print the dark blue layer on the Obama Progress poster, the translucent red layer on the rubylith would be carefully excised with an Exacto knife and peeled away from the clear base leaving the red layer in areas corresponding to the dark blue areas of the final poster. The most natural way to do this, given the starting point of the binary thresholded image in figure 8 (detail in figure 10) would be to print out the image using a black-and-white laser printer on a sheet of paper at the size of the final intended screen print. Then tape a layer of rubylith on top of the print. Then the artist would be able to use the printed image as a rough guide for cutting out the rubylith mask. The resulting rubylith mask could then either be used directly to expose the polymer layer on the screen to create the printing stencil for manual screen printing, or be used to create a digital master for commercial screen printing. Fairey employed the latter method.

21. Contemporary commercial screen printers employ digital devices to make the screens. These devices require that the image master be in digital form. So typically an artist will prepare a digital image master for screen printing using software such Adobe Illustrator. For artists such as Shepard Fairey who are formally trained in traditional manual screen printing techniques where the cutting of rubylith stencils is the preferred way to create the original image, a common way to produce an Illustrator file for commercial printing is to first cut the rubyliths by hand and then scan the rubyliths to create digital images that can be converted easily into Adobe Illustrator format. Once the rubyliths are scanned and converted into Illustrator format, the outlines of each color layer can be adjusted using the Illustrator tool set. As a result of this process, it is not uncommon to see slight variations between the image outlines in the rubyliths and in the Illustrator files produced from them.

22. Strong indications that Fairey followed this process can be gleaned first by examining two of the rubyliths and then by comparing those rubyliths to the Adobe Illustrator file from which the Hope poster was made.

Figure 8. On the left is one of the original Rubyliths (now part of a composite artwork hanging in a museum in Cincinnati). On the right is the dark blue layer from the Adobe Illustrator file.

23. A close comparison of these images leads to three conclusions: First, it is apparent that the dark-blue layer in the Illustrator file was derived from the rubylith. This is because substantial portions of the two images – for example, the shading

surrounding Obama's left temple – are exactly the same. The most likely explanation for that match is that the Illustrator file was derived from a digital scan of the rubylith.

24. Second, Fairey did, however, modify certain features of the digital scan of the rubylith using Adobe Illustrator or some similar program. Those modifications are evident in the very subtle differences in the contours of the edges (visible in Obama's right shoulder, left collar, and Adam's apple). Such modifications are typical of the kind of normal fine adjustments the artist would make to the Illustrator file before printing.

25. Third, it is apparent that a central step in Fairey's creative process was cutting the rubyliths by hand. The dark blue layer of the Obama Progress poster reproduced in Figure 10 shows the characteristic edges of a rubylith mask cut with an Exacto knife using Figure 9 as the underlying guide. Note that all of the edges in Figure 10 are rendered smoothly compared with the raggedness of the edges in Figure 9. This difference can be seen even more clearly in the enlargements in Figures 11 and 12. The edge of the hairline and the edges around the eye in Figure 12 are loosely modeled on the ragged edges in Figure 11, but in every way show the evidence of the artist's hand. Rather than render the edges as closely as possible to the binary threshold image in Figure 11, the artist has created an elegantly stylized hand-drawn effect.

26. This relationship between the edges in the binary threshold images and the edges in the Obama Progress poster is universal. No edges in the poster were derived by simply copying the edges in the binary thresholded images (fairey104739.tif, fairey104740.tif, fairey104741.tif, fairey104742.tif, fairey104743.tif, and fairey104744.tif). All of the edges in the poster have been hand drawn using a tool such as an Exacto knife cutting rubylith.

Figure 9. Image fairey104742.*tif produced by Shepard Fairey by applying the Photoshop Image>adjustments>threshold control to* fairey104758.*jpg to produce a pure black-and-white image. I was able to replicate this image exactly by applying the same control to* fairey104758.*jpg and setting the threshold value to pixel value 60, and thus I am certain that* fairey104742.*tif was derived from* fairey104758.*jpg.*

Figure 10. The dark blue layer on the Fairey Progress poster. All of the edges bounding the dark blue in this image have been rendered by hand. The tiny catch light in Obama's right eye is a deliberate addition by Fairey.

Figure 11. Detail of fairey104742.*tif.*

Figure 12. Dark blue layer from Fairey poster. All of the edges bounding the dark blue in this image have been rendered by hand.

27. In extensive experimentation with applying different binary threshold values to fairey104758.jpg, it is further evident that there would be no way to derive the precise outlines in the Obama Progress poster from fairey104758.jpg by any automated means. For example, in Photoshop it is possible to use artistic effect filters that will modify the edges of a black and white image. In figure 13, I have applied the Photoshop Cutout filter to fairey104742.tif using different combinations of the "edge fidelity" and "edge simplicity" parameters. But in every case the resulting image appears to have been produced by an automated process, and the lines do not appear to have been drawn by the hand of an artist.

Figure 13. Fairey104742.tif *on the left compared to two images derived automatically from it using the Photoshop Cutout filter with two different combinations of edge simplicity and edge fidelity. No combination of these parameters will yield the deliberate and elegant hand-drawn quality of line in the dark blue layer of Fairey's work.*

D. The Changes Made to the Original Image

28. In the course of the various stages in Fairey's creative process, he made many changes to the original image. These can be seen by comparing the original Garcia photograph submitted to the Associated Press and the Obama "Progress" poster. The differences between them include:

1. Rotation of the image by approximately 5 degrees in the clockwise direction. This makes the face appear more vertical and less cocked to the viewer's left.
2. Radical redrawing of Obama's right shoulder line to make it appear straighter.

3. Straightening of Obama's left collar and shoulder lines.
4. Addition of small trapezoidal highlights in both eyes to give the effect of a catch light in the eyes.
5. Redrawing the outlines of both ears to make them appear smooth and more perfectly shaped.
6. Adjusting the intersection of the hairline above both ears to reduce the effect of the ears protruding and thereby making the ears appear more elegant.
7. Straightening the line of the nose.
8. Straightening the lines defining the chin and neck.
9. Extending the length of the torso below the lower boundary in fairey104758.jpg.
10. Smoothing and stylizing the hairline.

Figure 14. The original Manual Garcia photograph as submitted to the Associated Press on the left and the final Fairey "Progress" poster on the right. The numbers are keyed to the list in paragraph 28 above.

Additionally, the portion of the light blue field appearing as narrow hash marks or hatching is a feature added in Illustrator.

E. The nature of the illustrator file

29. I was supplied the file "BARACK screen POSTER.ai" (the "Progress" poster) by Fairey's counsel. This is an Adobe Illustrator file. The file has been constructed by the artist as a master for offset or digital printing and is not suited for use directly as a master for screen printing. To understand why this is true it is necessary to understand the fundamental differences between the offset/digital processes and the screen process.

30. Screen printing employs opaque inks that are formulated to the exact colors of the poster and then printed and dried in layers to build up the complete image. The Obama Progress poster was printed using three solid colors on a cream colored paper. To produce this poster the printer would need to prepare three screens. The first layer of ink applied to the cream paper was the red. This was followed by the light blue layer of ink and then, finally, the dark blue layer. Each of the three inks is completely opaque. The red layer was prepared to slightly overlap the light blue layer at the edges where they meet to avoid the problem of the paper showing through if the two layers were slightly misaligned. The light blue layer was similarly adjusted to slightly overlap the dark blue layer to avoid the same problem.

31. Offset and digital processes typically work in a completely different way. Rather than printing with three different solid colored inks, offset and digital processes employ four standard "process color inks." These inks are transparent and can be combined by overprinting to produce a wide range of colors. The four standard process color inks are cyan, magenta, yellow, and black (CMYK). The colors in the Obama Progress poster can be produced by different combinations of these four inks. Table 1 shows the CMYK values for the four colors in the poster.

Table 1- CMYK values for four colors in Obama Hope poster

	Cyan	Magenta	Yellow	Black
Cream	1	9	40	0
Light blue	59	31	32	1
Red	9	100	100	2
Dark blue	100	78	44	41

32. The illustrator file (BARACK screen POSTER.ai) has been constructed for process color printing by either offset or digital. As a result, the file would have to be further processed before it could be used for screen printing with solid opaque colors. This would involve the conversion of the process color values in the Illustrator files into solid color layers. The combination of four process inks (CMYK) used to produce each color in the offset printed poster would be replaced by a single opaque ink. (The cream color would not be printed, but would be the color of the paper used in the screen

printing process.) This process of deriving the screen separations from the Adobe Illustrator file is described on page 26 of the deposition of Daniel Navar of Superb Graphics.

V. Summary of workflow used by Shepard Fairey to produce the Hope and Progress Posters

33. Putting together the conclusions set forth above, the following, in my opinion, is the most probable step-by-step workflow employed by Fairey in the creation of the posters:

a. Fairey obtained the low-resolution version (most likely a JPEG) of the Garcia photograph from a website on the Internet.
b. He converted the color image to grayscale using the Photoshop "mode change" tool.
c. He erased the background using the lasso tool to select the background and then deleted the pixel values in the selection.
d. He created a number of different binary images using different threshold values to obtain rough guides for producing the desired color layers.
e. He printed out the binary images on paper to use as guides to cut rubylith layers.
f. He taped layers of rubylith over the printed binary images.
g. He cut the rubylith layers.
h. He scanned the rubylith layers.
i. He imported the scanned and digitized rubylith layers into Adobe Illustrator.
j. He used the imported scanned layers to construct the Illustrator files. He then used Illustrator to make an additional series of adjustments to the image.
k. He added the text lines ("HOPE" or "PROGRESS") and the Obama symbol using Illustrator tools.
l. Finally Fairey submitted the Illustrator files to two different commercial printers (a commercial offset printer for the "Hope" poster and a commercial screen printer for the "Progress" poster) for mass production.

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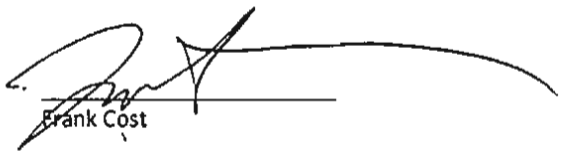

Frank Cost

October 1, 2010

EXHIBIT A

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Frank Cost is professor of digital imaging and publishing in the College of Imaging Arts and Sciences at Rochester Institute of Technology where he also currently serves as interim dean. The RIT College of Imaging Arts & Sciences offers academic programs in art, craft, design, new media publishing, photography, and film & animation. Professor Cost teaches undergraduate and graduate courses in digital imaging and new media publishing. He was also a founding co-director of the Printing Industry Center at RIT, an Alfred P. Sloan Foundation Industry Center, from 2001 through 2009. Rochester Institute of Technology (RIT) was selected in 2001 by the Alfred P. Sloan Foundation to become one of the Sloan Industry Centers. Professor Cost's research focuses on the impact of digital technology and digital culture on graphic communications.

Academic Employment History

- June 2009-present, Interim Dean, College of Imaging Arts & Sciences, Rochester Institute of Technology
- September 1997 to June 2009, Associate Dean, College of Imaging Arts & Sciences, Rochester Institute of Technology
- December 2001 to November 2009, Co-Director Sloan Printing Industry Center, College of Imaging Arts & Sciences, Rochester Institute of Technology
- July 1997 to present, Professor, College of Imaging Arts & Sciences, Rochester Institute of Technology
- July 1992 to June 1997, Associate Professor, College of Imaging Arts & Sciences, Rochester Institute of Technology
- July 1987 to June 1992, Assistant Professor, College of Imaging Arts & Sciences, Rochester Institute of Technology
- Tenure awarded, April 1988
- July 1982 to June 1988, Instructor, Imaging Technology, College of Imaging Arts & Sciences, Rochester Institute of Technology

Recent Research Projects (Creative)

- Instant Book Project (2006-2010). Development of novel approaches to the production of a new genre of "extended moment" photo books. This project is ongoing and has been funded by grants from HP and Xerox Corporation.

Recent Research Projects (Technical)

- Development of a web-based publishing system to convert online content into printed documents. HP 2008 Innovation Grant.

- Web-based Collaborative Photo Book Publishing System (2007-2008). Defined and scoped the project and co-managed the team of student developers. This project was funded by a development grant from HP.

Recent Research Projects (Industry Studies)

- Emerging Global Print Markets: A five Country Comparative Study (2006). An analysis of print markets in China, India, Russia, Mexico and Brazil. With Professor Stanley Widrick, RIT Saunders College of Business.

- Lean Manufacturing in Small and Medium Sized Printers (2005). With Professor Sandra Rothenberg, RIT Saunders College of Business.

- Digital Integration and the Lean Manufacturing Practices of U.S. Printing Firms (2004).

- Design to Production: The Critical Interface (2003).

Recent presentations

- 2010 Digital Imaging Marketing Association, The Future of Photo Publishing.

- 2008 Indo-American Print Summit, September 2008, New Delhi, Presentations on US Outsourcing of Premedia Services to India and China, and Current State of Digital Print Technology.

- 2006 Lyra Research Imaging Symposum, January 2007, Keynote address entitled The Future of Digital Creativity.

Books (in print)

- Pocket Guide to Digital Printing (Delmar 1997). English and Chinese language editions.

- The New Medium of Print: Material Communication in the Internet Age (RIT Cary Graphic Arts Press, 2005).

- The Book as Child of the Internet (Fossil Press, 2007).

Education

- BA World History, Eisenhower College, 1976. High Honors.

- MS Computer Science, Rochester Institute of Technology, 1987. Thesis: The Design and Implementation of a System for Processing Documents Described in Generalized Markup Languages