WHITE PAPER

spencerLAB
DIGITAL COLOR LABORATORY

Stream Concept Press from Kodak — On the way to Offset-Class Print Quality

Inkjet technology is coming of age – for production!

With manufacturers presently competing for position at the opening gate, **print quality, speed, reliability**, and **cost** will be decisive purchasing factors. These high-speed inkjet web presses are targeting markets such as transactional and promotional pieces, brochures, catalogs, and direct mail.

We took an early look at the Stream Concept Press from Kodak in order to estimate its potential. As Offset printing has long been considered the "gold standard" for commercial printing, our comparison of Stream output to Offset output seemed logical. Throughout our study, improvements were being made and the Stream Press development moved forward. The improvements seen during the duration of our study are encouraging predictors for future advancements and final release. Despite competing with the 2400x2400 dpi addressability and associated dot size, the Stream Concept Press offers output that is surprisingly competitive.

The *SpencerLab* Digital Color Laboratory was commissioned by Eastman Kodak to perform this independent comparison of the print quality of the Stream Concept Press and Offset.

Executive Summary

In this report we are focusing on the capabilities and potential of the Stream Concept Press. We believe this is a very successful "proof-of-concept" device, and we see the potential for a press that, upon maturity, will be able to provide competitive Offset-class output.

With speed upward of 500 feet/minute and print quality comparable to or approaching Offset, Stream has the potential of being a key player in this growth segment.

While the Stream Concept Press is not ready for prime time, it is impressive. At this juncture, improvement is needed in color management, registration and printhead alignment – yet this is still a fine showing of their unique continuous inkjet technology.

Key Findings

Our analysis found that ***overall, the Stream Concept Press from Kodak demonstrates the potential of approaching 175-line Offset print quality.***

To be sure, there were some areas of print quality that still need significant development – it is, after all, a "Concept" press – but we also found a few areas where its technology promises to surpass Offset print quality.

Images were one area of impressive print quality, particularly on glossy media. Gamut volume was 35% larger than 175-line Offset in our tests (both magenta-blue-cyan and yellow-red areas were larger without compromising cyan-green). Black density was 29% higher at 1.90 *vs.* 1.47 ODU. Highlight and shadow detail could utilize a full 1%-99% halftone range. Overall image quality was striking.

Tints & Blends were another area of good print quality, benefiting from Stream's FM screening algorithm – comparable in our tests to 175-line Offset on glossy media.

Text & Lines, both color and grayscale, benefit as tints do, with high uniformity and associated legibility; however, primary color and black text & lines were rendered thicker with less edge sharpness.

Results of Analysis

Methodology

Key elements of our methodology included a) selection of appropriate test files, b) determination of comparable print media, c) identification of a representative Offset printing facility, d) supervision of the actual printing, and e) analysis of comparative print quality.

Test files need to push the limits of IMAGE, TINT & BLEND, and TEXT & LINE reproduction. For this purpose, we selected PDF versions of four in-house-coded PostScript files, three photographs, and a text and graphics composite from the recently-released *SpencerLab* Printer Test Suite (ver. 4) [see illustration, right]. Some pre-processing (not enhancement) was required for the developmental DFE/RIP of the Stream Concept Press.

Test Files from the *SpencerLab* Printer Test Suite

Offset media comparable to Stream developmental media – two coated (glossy and dull finish) and one uncoated (plain) – were specified: NewPage Sterling Ultra Gloss (80# text), Hansol Global Fibres Titan Dull (70# text), and IP Williamsburg Offset (60# text).

Research to identify a high-level offset printer led us to a Heidelberg Speedmaster 74 sheet-fed offset press with a Kodak 5080 Trendsetter VLF Quantum platemaker at the Print Applications Laboratory of the Rochester Institute of Technology. Printing at 133-line and 175-line screening was supervised on-site by *SpencerLab* personnel. Printing on the Stream Concept Press was also supervised by *SpencerLab* personnel at Kodak's development facility.

Print quality was analyzed comparatively by a team of experienced *SpencerLab* analysts – within the expected range appropriate to the intended applications – noting the areas of IMAGES, TINTS & BLENDS, TEXT & LINES, and COLOR GAMUT & DENSITY, all on appropriate media.

Images

Images – visual perception of ideas and products – are used to easily communicate a message to the audience, "a picture is worth a thousand words". Often it is the images on a page that command readers' first attention.

Image print quality is most important – images must be rendered pleasingly with realism, richness, sharpness, and lack of defects to most effectively deliver their value. They need to be rendered with the right balance of contrast, highlight & shadow detail, color, and definition.

Overall, Stream images edged above the 133-line Offset print quality and approached 175-line Offset quality on all three media types.

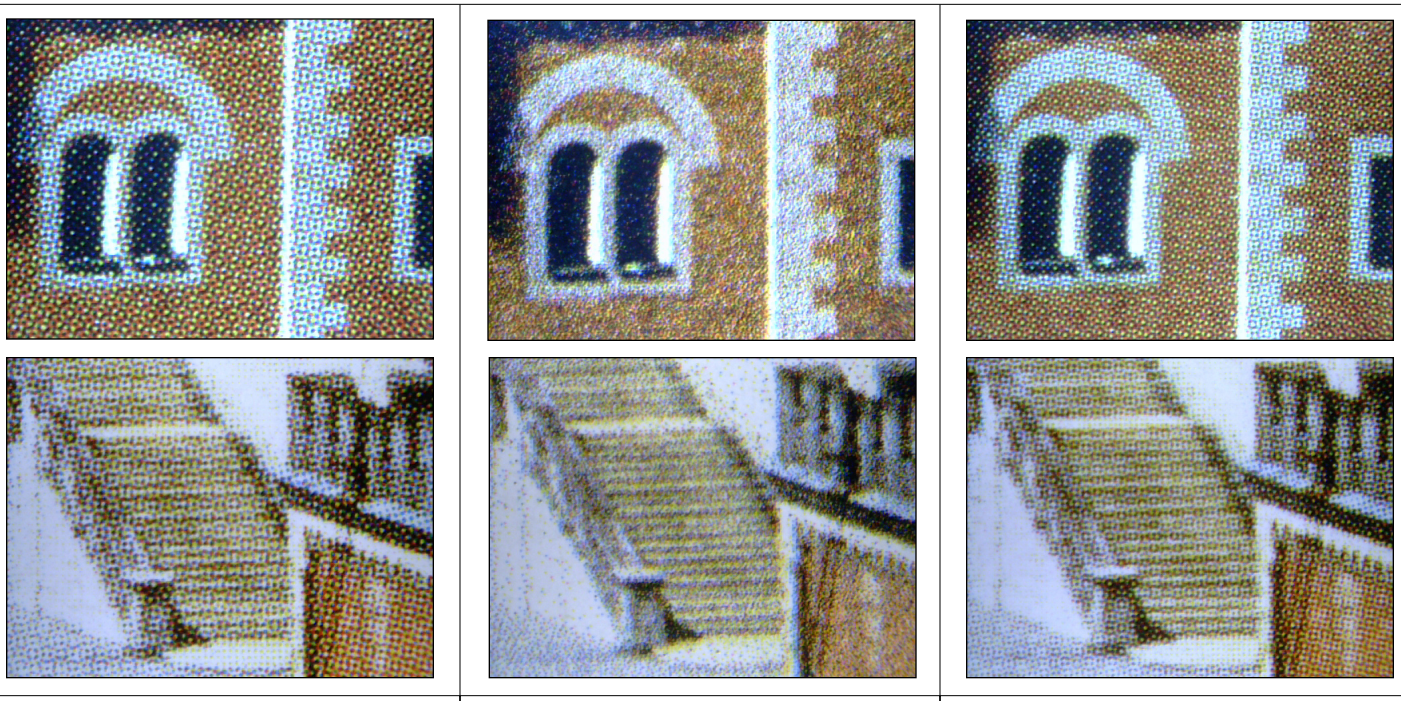
Stream images have higher contrast than Offset. In addition, the Stream prints preserved more shadow detail than Offset, though highlight details were comparable. In particular, Offset prints lost more shadow detail on the uncoated media.

Overall color was surprisingly competitive, with Stream prints having better realism while the Offset prints exhibited better saturation and richness.

Image definition on the Stream prints was often higher than 133-line Offset and comparable to 175-line Offset. For example, on glossy media we found that counting the number of steps was problematic on the 133-line Offset, but straightforward on the Stream and 175-line Offset [see illustration, following page].

Both Stream Concept Press and Offset prints exhibited some contouring on images. Some mottling was visible

Image Sharpness Comparison Examples (*Castle* extracts)



Offset – 133-line	Stream Concept Press	Offset – 175-line

on Stream prints on dull and plain media. Screening patterns were visible on both Stream and Offset prints, particularly on high coverage areas on coated media, thus detracting from overall print quality appearance; this added a grainy and soft appearance on Stream while showing a distracting rosette pattern on Offset, especially at 133-line.

Tints & Blends

Tints are large areas of a single color that are sensitive to artifacts and graininess – they should be smooth and uniform. Blends are transitions between two or more tints, whether from highlight to shadow or between different hues – they too should be rendered smoothly without showing harsh steps from highlights to shadows or from color-to-color. Tint smoothness and uniformity depend primarily on the printing engine or mechanism, while blend smoothness depends more upon the adjacent color-to-color processing of the DFE/RIP.

As the use of color in printing increases, more and more innovative ideas are being implemented by document creators. Efficient use of tints & blends can help enhance the overall appeal of a document and add value by enhancing visual appeal – color has been shown to increase direct marketing response rates.

On glossy media, the Stream Concept Press rendered tints at least comparable to 175-line Offset quality and well above that of 133-line Offset.

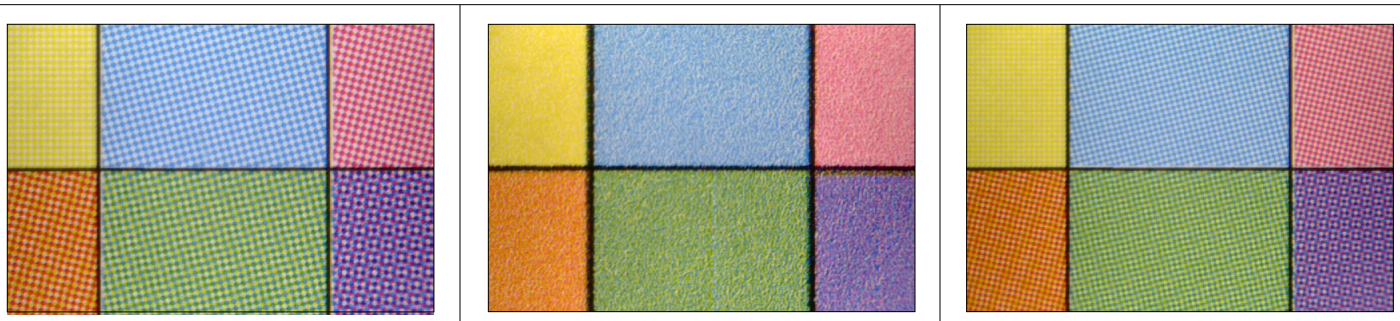
Screening patterns were noticeable on both Stream and Offset tints. The 133-line Offset tints showed distracting screening patterns making those tints less smooth than Stream tints. Graininess on the 175-line Offset prints was at a lower spatial frequency than on Stream prints. Overall the Stream prints were comparable to the 175-line Offset prints [see illustration, following page].

As with images, Stream tints exhibited some mottling on dull and plain media; 133-line Offset tints showed some mottling on plain media as well. Stream tints appeared slightly desaturated on dull media; on plain media 133-line Offset tints appeared slightly desaturated compared to Stream.

Stream prints were rendered with smooth color blends overall, comparable to both 133-line and 175-line Offset, although there was some room for improvement on dull media in the fully saturated blue (cyan+magenta).

Minor uneven color transforms in Highlight-Shadow blends were noticeable on all. Stream prints showed some uneven transitions in cyan and cyan-based secondaries (greens and blues), whereas Offset prints showed some

Tint Comparison Examples (*Color Graphic* extracts)



Offset – 133-line	Stream Concept Press	Offset – 175-line

harsh color transitions near yellow and blue. Color-to-color blends were rendered smoothly overall – Stream and Offset prints were comparable. Stream prints showed a slightly uneven transition in blue-magenta color blends and Offset in yellow-green color blends.

Text & Lines

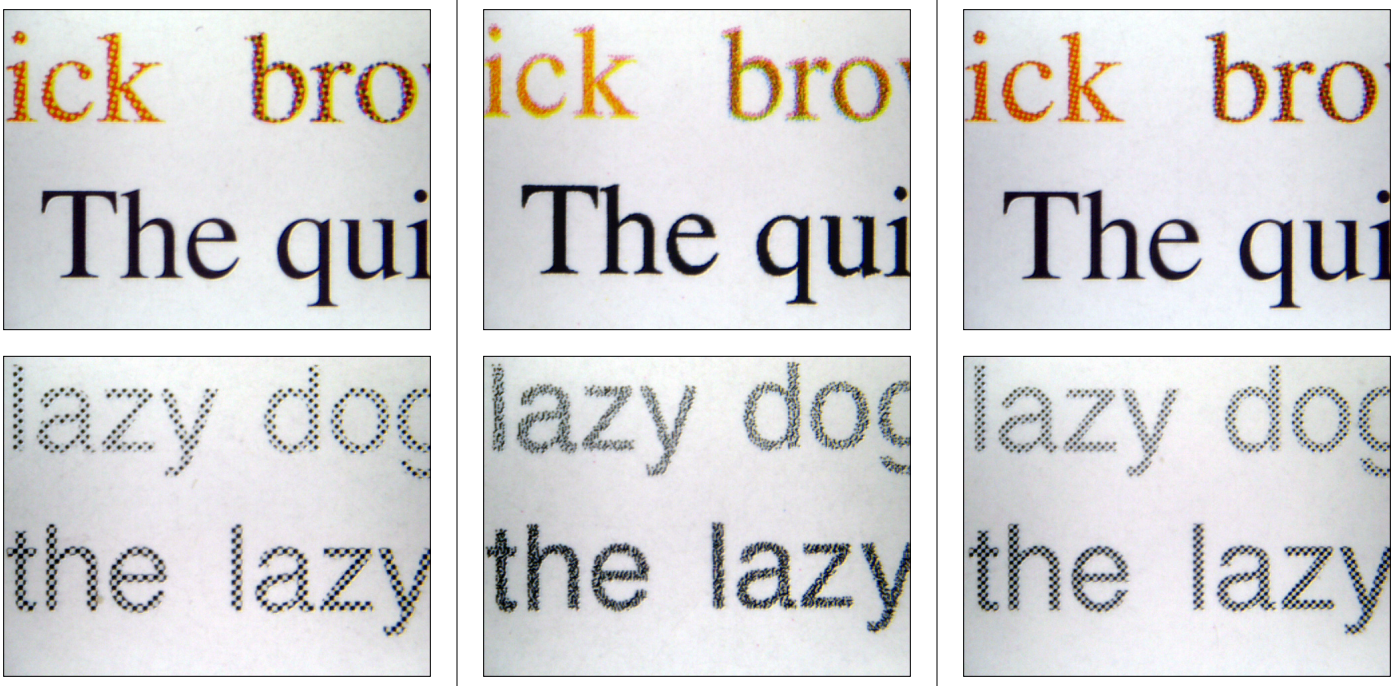
Text and Lines are the most common elements of a document, and should communicate information to the audience in a clear and appropriate, yet unobtrusive way, lest it compromise the document's value. Text should be rendered cleanly and legibly. Lines must be smooth, sharp, and well defined for the document to maintain its professional appeal.

Text

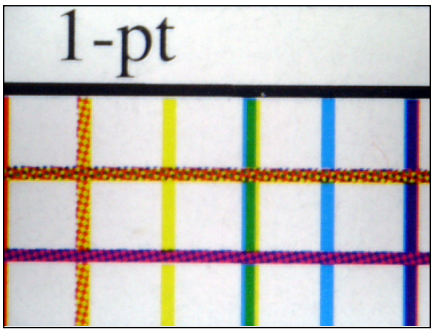
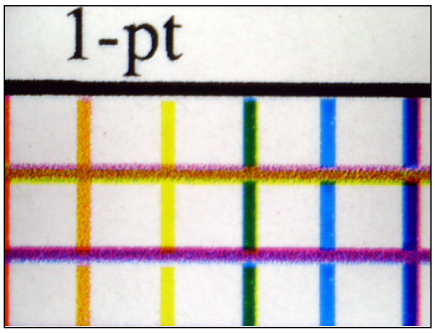
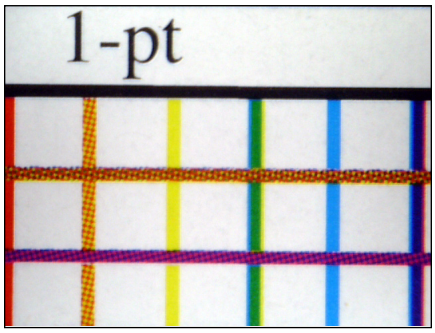
Rich black text helps enhance the communication of a document's message. On glossy and plain media, black text stands out much more on Stream prints than on either 133-line or 175-line Offset prints. Stream text was rendered slightly thicker and less smoothly than Offset, but came very close to its crispness. Black text was rendered uniformly, maintaining good legibility even down to 2-point size. The Stream prints displayed black text that was rendered with overall good quality, acceptable for most high-end applications.

Color text is used to highlight key points in a document and to draw the readers' attention. Primary and secondary

Color and Gray 12-point Text Comparison Examples (*Color Spectrum* extracts)



Offset – 133-line	Stream Concept Press	Offset – 175-line

Lines Comparison Examples (*Color Spectrum* extracts)		
		
Offset – 133-line	**Stream Concept Press**	**Offset – 175-line**

color text of Stream and Offset prints maintained the characteristics of the black text comparison. However, in most colors (other than those that contain a full 100% of any CMYK components; *e.g.*, pink, orange, or brown as well as gray) the screening differences noted in tints have a strong impact on legibility. Edge smoothness and legibility suffer in 12-point text and below, particularly on 133-line Offset; Stream and 175-line Offset smoothness was comparable [see illustration, prior page].

Reverse text, although less common, may be used in some applications typically in font sizes larger than 12-point (and some smaller sizes in bold). On glossy media, Stream prints' reverse black text was free of minor fill-ins down to 10-point Times Italic (a particularly difficult serif face) and was legible even down to 4-point, while on Offset prints reverse black text was legible down to 2-point and was free of minor fill-ins down to 4-point. Dull and plain media Stream prints were free of minor fill-ins down to 12-point Times Italic, while Offset on plain media was free of minor fill-ins down to 6-point size. The quality of reverse text on Stream prints surpassed most typical use requirements for the target markets.

Lines

Applications typically use lines as rules and in call-outs as well as in computer graphic illustrations that require clean and crisp line rendition. Use of lines is frequent in TransPromo documents, and some commercial applications may involve use of complex line illustrations.

As with black text, black lines on Stream output were crisp and stand out, although they were rendered slightly thicker and less smoothly than Offset. Stream rendition was uniform with no loss of detail and thickness maintained well, particularly on straight lines. Overall black line quality approached that of Offset. Primary and secondary color lines were similar to black.

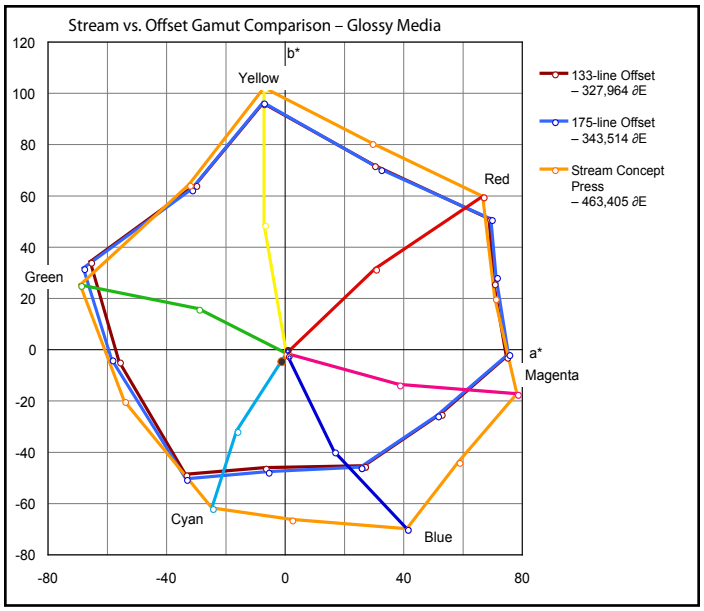
Most color and gray lines were rendered with some visible screening on both Stream and Offset prints, but still appeared acceptable in quality. Stream color lines were smoother than 133-line Offset and their quality appeared close to 175-line Offset lines.

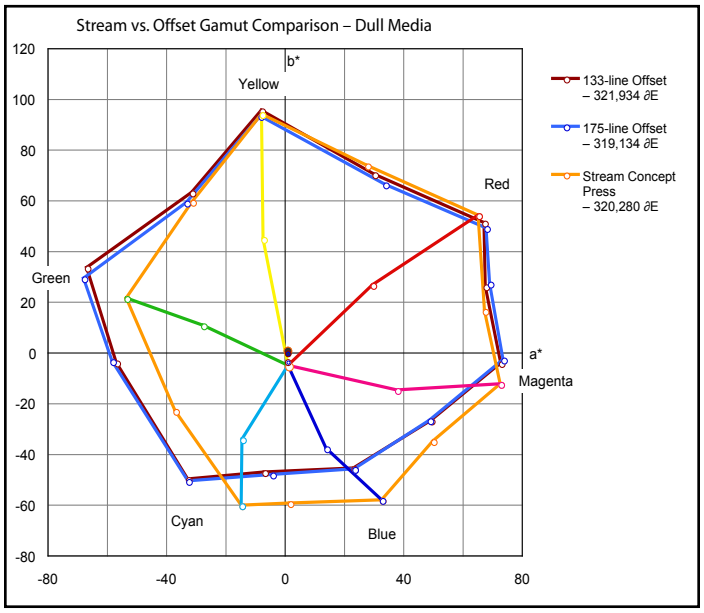
Color Gamut Volume & Black Density

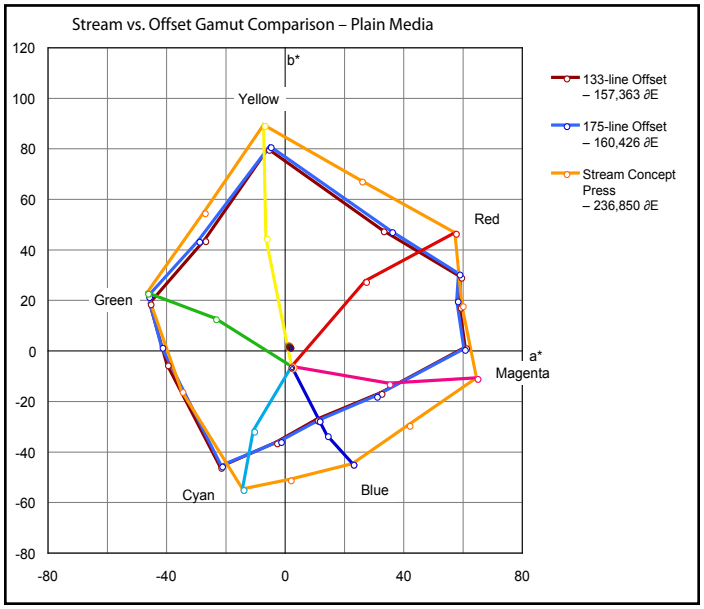
Gamut Volume of a printer refers to the range of colors the device can produce. Be it a desktop printer, a digital press or a commercial Offset press, larger gamut means more producible colors and the ability to attain better differentiation of close colors on output. High Black Density offers better impact on text, lines and images. It makes the text and lines appear rich and stand out, which facilitates effective communication, and allows more visible highlight and shadow detail in images.

The overall color gamut volumes of the Stream prints were significantly larger than Offset on glossy and plain media; on dull media gamut volumes were essentially equal. On glossy media the Stream prints had a 41% larger gamut volume than 133-line Offset and 35% larger than 175-line Offset. On plain media the Stream prints had a very impressive 51% larger gamut volume than 133-line Offset and 48% larger than 175-line Offset. Both magenta-blue-cyan and yellow-red areas were larger on Stream prints without compromising cyan-green [see 2-dimensional projections of the 3-dimensional gamut volumes, following page].

The fact that the gamut volume of Stream prints on dull media was merely equal to 133-line and 175-line Offset indicates an opportunity for improvement.



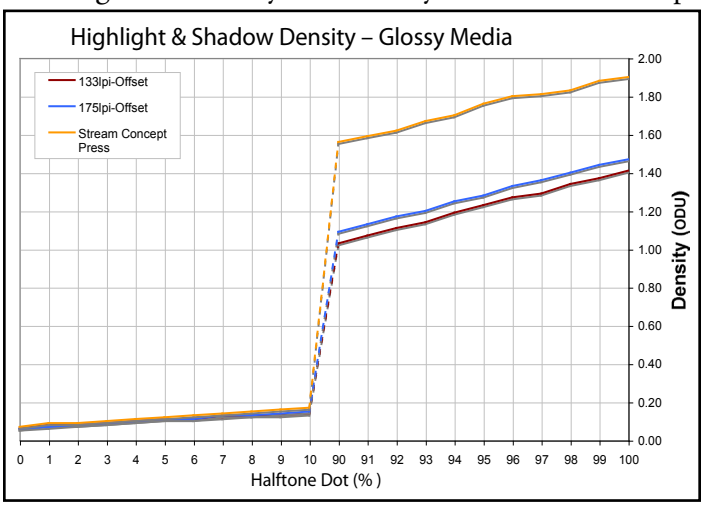


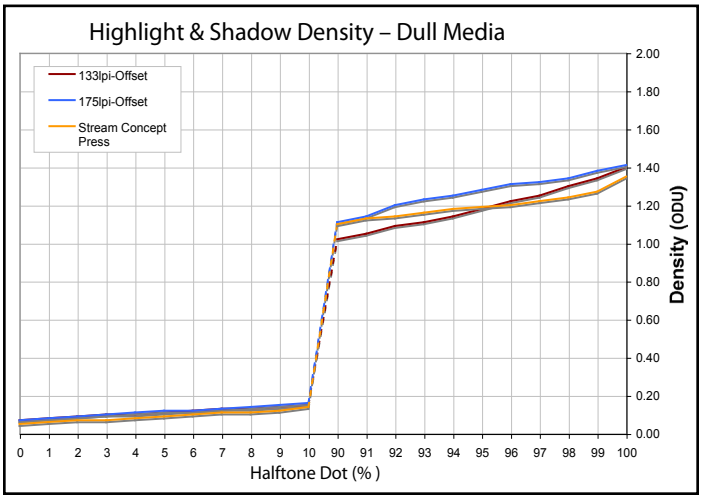


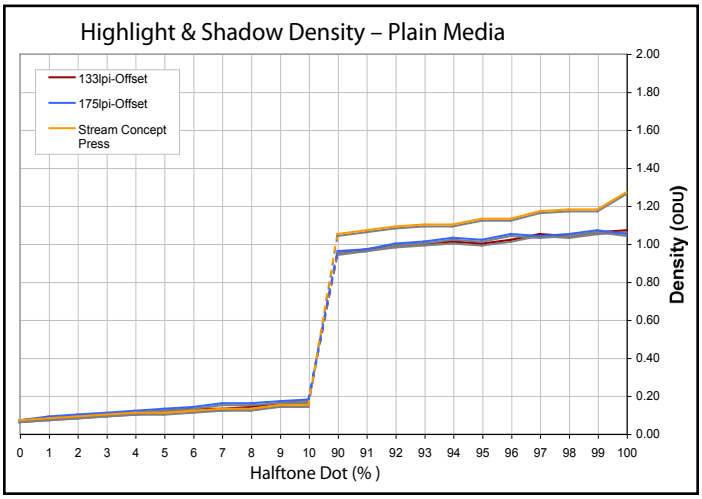
The significantly larger gamut volume of Stream prints relative to both 133-line and 175-line Offset on both plain and glossy media opens the potential (some of which has not yet been achieved) for printing richer photographs and documents with higher impact than Offset.

Black Density

Our most significant finding in this area was the outstanding black density achieved by the Stream Concept







Press on glossy media: 1.90 ODU. This was substantially higher than the 133-line and 175-line Offset prints (1.41 and 1.47 ODU, respectively).

The black density achieved by the Stream on dull media was about 0.05 ODU lower than Offset on corresponding media: 1.35 ODU vs. 1.40 and 1.41 ODU on the 133-line and 175-line Offset, respectively.

On plain media, the black density achieved by the Stream was once again noticeably higher than Offset on corresponding media by about 0.2 ODU at 1.27 ODU. The 133-line and 175-line Offset measured 1.07 and 1.05 ODU, respectively.

Prints from both the Stream and Offset presses on all three media held halftone dot values of 1% through 99%. This ability to hold halftone values through the entire 1-99% range offers the potential of good highlight and shadow detail in images.

THE *spencerLAB* DIGITAL COLOR LABORATORY

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