RESOLUTION ENHANCEMENT TECHNOLOGIES:

WHAT IS 600x600dpi OPTICAL and WHAT is 3600 or EVEN 4800dpi APPARENT PRINT RESOLUTION? - Part 2

Vladimir Kamenov, PhD

PhD eng. Vladimir Kamenov has a master engineering degree in Precision Mechanical Engineering and a Ph.D. degree in Applied Mechanics from the Bulgarian Academy of Sciences. He has worked in the field of office equipment engineering for 5 years. He is a lecturer at the Technical University – Sofia since 2005, where teaches the following subjects: "Office equipment engineering" and "Color management and prepress processes in office equipment". He is also the leader of the science project "Development of a methodology and an experimental stand for quality assessment of color printing office equipment".

Continued from the May issue of RechargEast Magazine:

3. Superior image enhancements

Benefit: Excellent tone scale, text sharpness, and line clarity out-of-the-box

Technologies: Image Mode; and edge control, including adaptive half-toning; accurate half-toning, automatic in-RIP trapping; in-RIP halo reduction; Color REt; and neutral gray treatment

Excellent edge control

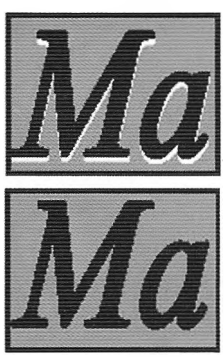
Edge control is comprised of three components: adaptive half-toning, trapping, and Color REt. These components affect edges and near edges and are designed into the printer through HP proprietary technologies; they occur automatically and do not affect printing performance or speed. They are described below:

Color RET

Color REt is a proprietary HP technology that has been adapted from monochrome HP LaserJet printers to include color. Color REt is a new feature that smoothes edges by intelligently changing the size and position of the dots that make up the edge of a solid object. It is optimized to work on solid color edges: red, blue, green, black, and other solid colors. This ability to grow and move dots increases the apparent resolution well above the engine's native addressability.

TRAPPING

Automatic In-RIP Trapping is an HP-patented image enhancement feature that involves deliberately overlapping one color onto another to guarantee high-quality edges between adjacent colors. HP trapping is unique compared with traditional press implementation because it includes halo reduction. While it used to take graphic designers or commercial press operators many hours to do this manually, the HP-enhanced version is offered as standard, performed automatically, and with no performance penalty.



Without trapping

With trapping

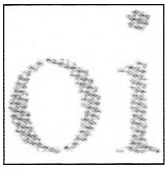
HALO REDUCTION

Automatic In-Rip halo reduction makes one color intelligently recede from the edge of the other color, reducing the overlap and making it less visible. For example, a process black line is composed of black, the dominant color, and cyan and magenta, the subordinate colors. The cyan and magenta near the edge of the black line are reduced or removed. This prevents color from being seen on the edge of the black line. Halo reduction can also be applied to other line colors, like green lines, where cyan is dominant and yellow is the subordinate color.

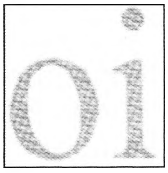
ADAPTIVE HALFTONING

Adaptive Half-toning is an HP-patented image enhancement feature that increases edge smoothness of text and graphics while maintaining the quality of area fills. One of the difficulties of digital color printing is producing smooth area color while at the same time producing smooth edges. Adaptive Half-toning provides a solution to this problem. Smooth area color is optimized by selecting low frequency digital halftones. The

color is built up by turning on and off dots. At a normal viewing distance, your eye blends the dots together so the color looks smooth. Using low-frequency halftones creates smoother, more accurate color in large areas. Edge sharpness is optimized by selecting high-frequency digital halftones. While the eye blends the dots in smooth areas, it is also very good at discriminating minor variations at edges. High-frequency halftones are used to smooth the jagged edges. Adaptive Half-toning provides a solution to the requirement for smooth color and smooth crisp edges by locating and increasing the digital halftone frequency at edges. This is a patented technology developed by HP. It is implemented in specialized electronics to provide fast printing performance.



12 pt text without adaptive half-toning



12 pt text with adaptive half-toning

ACCURATE HALF-TONING

The consistency and reliability of the printer's engine, combined with smooth printing that is nearly artifact free, allows for higher halftone frequencies that produce accurate halftones. The higher frequencies and other HP Image REt 3600 print system elements including HP's proprietary software enhancements and HP's high resolution imaging system result in best in class image detail, crisp text and graphics. For digital laser printers, a halftone is a collection of dots within a cell. HP proprietary technology varies dot placement and density within the 600 dpi position grid. Cells are repeated at a fixed frequency, which is also referred to as the halftone screen frequency. The frequency is dependent on a number of elements, including the media, color stability, and dot control. In commercial press, newsprint is typically about 85 lpi (a screen frequency of 85 lines per inch). Book and magazine screen frequencies vary from about 100 lpi to about 300 lpi. The lower the halftone screen frequency, the more visible the halftoning is to the human eye. For laser printers, the quality of the print mechanism and consumables enable higher halftoning frequencies.

NEUTRAL GRAY TREATMENT

This feature allows the selection of the neutral gray treatment of either black-only or four-color process grays. Black-only can be selected to print black text, delivering sharp, high contrast text and lines. If four-color grays are selected, black is printed using all four process colors (cyan, magenta, yellow, and black), known as process grays. This selection is useful for printing photographs, since it produces richer grays and blacks that blend smoothly with surrounding colors.

4. HP glossy laser paper system optimization

Benefit: Optimized output on HP glossy laser photo paper, reliable performance on a variety of media types in a range of environments

Technologies: Media type sensor, Instant-on Technology with selective gloss, media electrical property compensation

System-optimized for HP glossy laser photo paper

In order to make a greater impact on a customer, client, or manager, important business documents are often printed on higher quality papers than those used in the general office. These papers typically range in weights from 105 g/m2 to 220 g/m2 (80 lb. cover, 58 lb. bond) or higher, and have a matte, satin, or glossy finish. While hundreds of grades of such papers are available in commercial markets, they are designed for the needs of offset and digital presses or other production equipment, not for the technical printing requirements of desktop and networked color laser printers.

Over the past few years, several coated papers in the 120 g/m2 (32 lb. bond) range have been introduced that were positioned for use on laser printers, but HP testing indicates they often produce undesirable results. Generally speaking, with color laser printers, the heavier and glossier a paper is, the more difficult it is to print on successfully. This technological barrier is evidenced by the absence of heavier, glossier papers specifically for color laser printing, such as those typically used for brochures, business photos, and marketing materials. Research indicates that many businesses are interested in using heavy, glossy coated papers for these applications on color laser printers but have had limited success in doing so with the products that are currently available.

A unique technology

Most coated two-side papers on the market have a single coating layer on each side. HP's formulation begins with an advanced five-layer structure. Each of the five complex layers is specifically designed to address the issues discussed above. This design supports the trouble-free printing of high-quality documents on HP Color LaserJet printers. (See Figure A).

The science behind HP's new unique design ensures superior results in image quality, blister control, runnability, gloss stability (after fusing), and appearance. The figure below illustrates the paper's construction:

Available paper based on this new technology include:

- HP Color Laser Brochure Paper, Glossy
- HP Color Laser Photo Paper, Glossy
- HP Superior Laser Paper 160, glossy
- HP Photo Laser Paper 220, glossy

Media type sensing

One advantage of laser printing is the laser printer's ability to print on a wide variety of media, including common office papers, heavy paper, glossy paper, glossy film, and overhead transparencies. However, to achieve the best print quality, the printer must be configured differently for each media type.

Because users don't always know that they need to configure for media type or how to do so, the printer automatically detects the loaded media type and selects the proper print mode without user intervention.

To ensure ease of use and high-quality results, the printer delivers optimized print quality regardless of the media type. For a wide variety of media, the printer's media type sensor automatically detects the media type and configures printer settings to provide optimized print quality. The media sensor is enabled when printing from the multipurpose tray by default, and is available for printing from all other trays via the control panel.

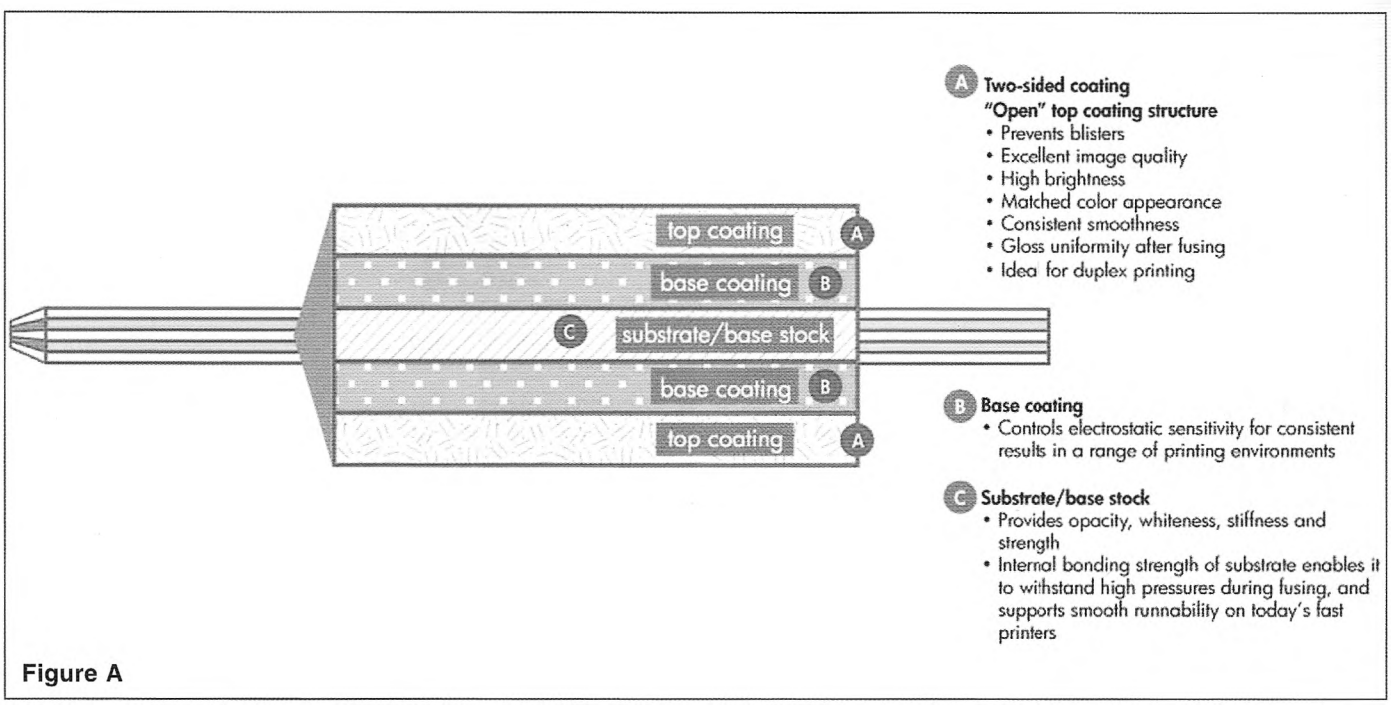
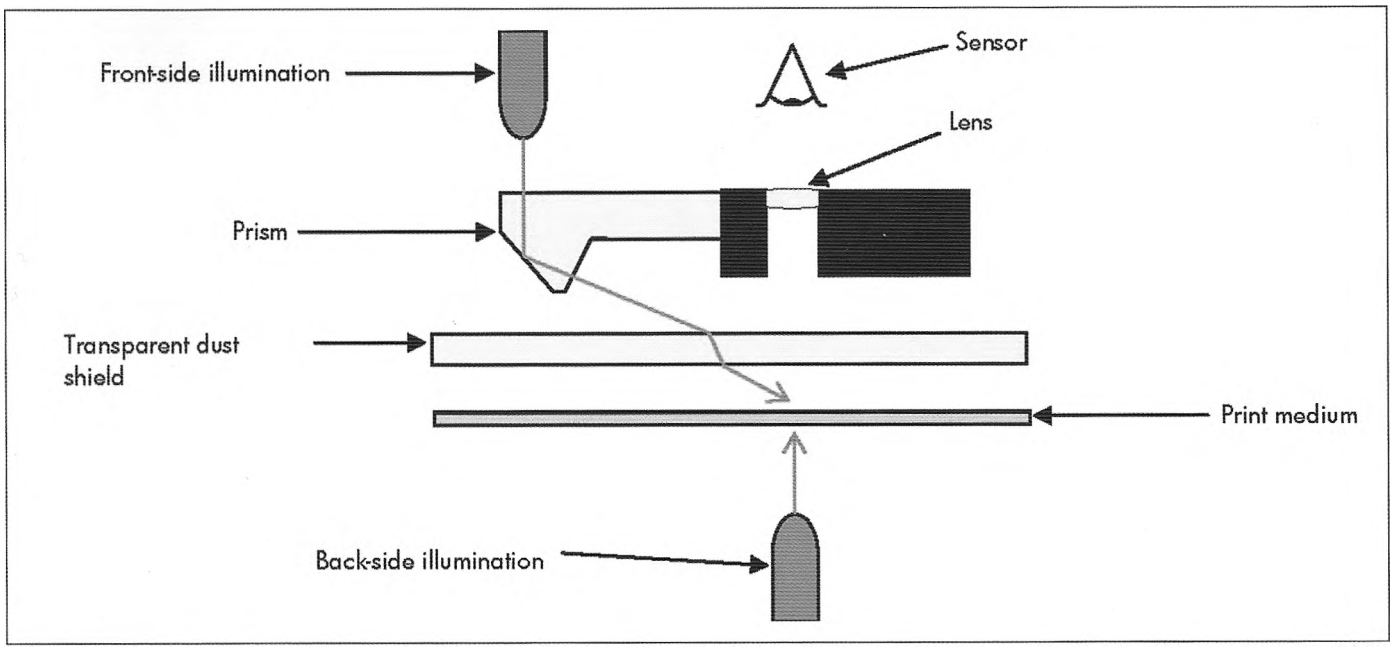


Figure A



Automatic transfer voltage control system

The printer's automatic transfer voltage control (ATVC) system combines media type sensing with environmental sensing, which significantly enhances the printer's ease of use and provides great print quality regardless of media type or environmental conditions.

5. HP Smart printing supplies with HP ColorSphere toner

Benefit: Efficient and easy to use color, consistent image quality, oil-free fusing, superior image detail, and sharp text and line art

Technologies: HP Smart printing supplies with HP ColorSphere toner

HP ColorSphere toner delivers:

- Higher, more uniform gloss on glossy paper with faster, more complete fusing of toner to paper
- A wide range of available colors for more lifelike flesh tones, shading and gradations

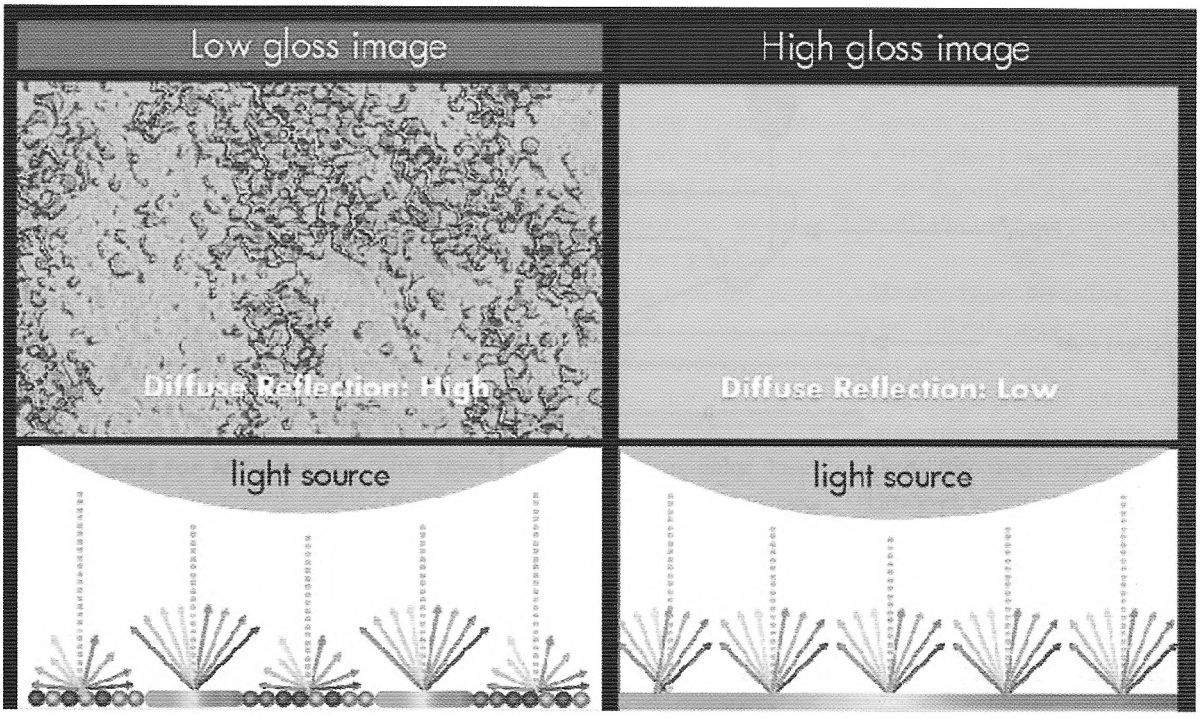


Figure B: More complete fusing results in a smoother surface which means lower diffuse reflection

• Precise placement of toner particles for consistently vibrant colors and clean lines
• Additives specifically designed to maintain charge control for reliable performance across different environmental conditions
• Additives that are molecularly bonded to toner particles to keep them intact, which helps ensure consistent output quality throughout the life of each print cartridge
• Unique toner formulations that are optimized for each HP LaserJet printer and the environmental conditions in which it must perform

Improved gloss on glossy paper

When color toner uniformly fuses to paper, the gloss level increases and transitions from one color to another are more glossy and smoother. HP ColorSphere toner was designed to provide high gloss, uniform output by carefully controlling the ratios of key ingredients in the toner. (See Fig. B)

Lower diffuse reflection means higher gloss when compared with previous HP color toner. HP ColorSphere toner achieves up to 40% higher gloss using high-gloss mode on HP Laser Glossy Photo and Imaging Paper over HP's award-winning older model - HP Color LaserJet 4650. Percentage improvements are based on internal testing using Industry Standard 75 degree Gloss Meter.

Better overall print quality through precise size, shape and charge control

Color laser print quality depends greatly on the precision with which toner flows through the printing system and is placed on paper. That precision depends on the ability to tightly control the electrostatic charge of toner particles.

Toner particles with uniform size and shape behave in a consistent manner. Uniformity can be measured by looking at the distribution of particle sizes, shapes, and additive content in a given sample.

HP LaserJet printing systems are designed to place HP toner in an efficient and precise manner. Therefore, the end result of particle uniformity is a high-quality output with vibrant, well-defined colors and crisp, clean lines.

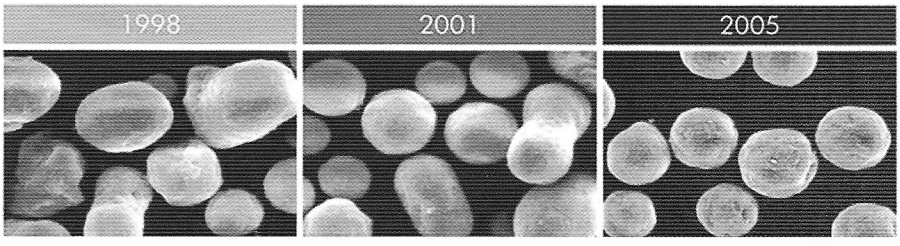


Figure C: Improvements over time have made HP ColorSphere toner more uniform in particle size, size distribution and shape. Toner charges faster, enables faster fusing, and maintains its charge throughout the life of the cartridge.

Precise charge control of toner particles is also partially dependent on surface additives. Particles with a consistent amount of additives in relation to their total mass and a consistently spherical shape will allow for much greater charge control and therefore enable higher-quality printing. RCE