meteor

White Paper

FULL SPEED AHEAD

Recent advances in printhead drive electronics and software can dramatically improve print quality in high-speed, single-pass inkjet

Authors: David Heath, Technical Sales and Marketing Manager, and Tracey Brown, Director of Strategy and Marketing

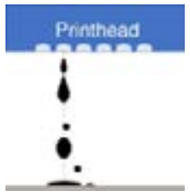
Overview

From the exceptional print quality requirements of commercial labels to the non-contact robustness needed for ceramic tile decoration, to the precision deposition capability demanded by printed electronics, adoption of inkjet technology in industrial environments continues to expand and amaze. Years of focussed development have yielded highly reliable printheads which work with an unending stream of fluids but jetting, by its nature, will always present some level of challenge.

To date, most industrial inkjet printers are scanning systems where multiple passes of the printhead mask common jetting issues, usually at the expense of throughput. Recent advances in electronics and software are fuelling growth in single-pass systems, paving the way for speeds and print quality which rival the best analog print technologies.

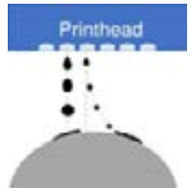
Common jetting issues

Jetting issues generally fall into three main categories: satellites, jet deviation and missing nozzles.



Satellites are undesired drops which are separate from the main drop. Not to be confused with droplets intentionally created by grey-scale printheads, satellites are a nuisance, causing fluid to land in the wrong place on the substrate or in the environment. Satellites can be caused during drop formation by suboptimal printhead waveforms, excessive drive voltage or, most commonly, by low ink surface tension. Often satellites are smaller than the main drop causing them to respond differently to air currents or static charge on the substrate.

Jet deviation can have any number of causes including debris on the printhead faceplate, air trapped in the nozzle, incorrect faceplate wetting or even a build-up of ink mist on the faceplate. The straighter and faster the jet, the better the drop placement accuracy. Non-flat or uneven surfaces present special challenges, especially in grey-scale printing where drops vary in size.



Missing nozzles can occur at the onset of printing or they can develop over time. Causes include fluid starvation (due to a blocked filter or insufficient flow through a recirculating printhead), trapped air within nozzles, debris or cured fluid within nozzles, damaged printheads, incorrect meniscus pressure or a sub-optimal printhead waveform. The impact of missing is greater for single-pass systems.

Conventional solutions

Once a jetting reliability problem is identified (often no easy task), the solution may be obvious, though sometimes tricky to implement. Satellite problems can be eliminated through careful printhead waveform design. Drop placement inaccuracies exacerbated by large or varying throw distances might benefit from the adjustment of print timing or the tweaking of image data. Well-executed printhead maintenance procedures coupled with clever tricks such as the utilisation of electronic tickle pulses to keep fluid in motion can help to relieve jet deviation problems. And there are as many techniques for recovering missing nozzles as there are causes. These include addressing issues of fluid starvation with plumbing modifications or ink delivery system adjustment, implementing priming and spitting processes to help with clearing trapped air or debris within nozzles and the creation of special waveforms to discourage de-priming.

The future is now

Conventional solutions to common jetting issues are often sufficient for scanning printers but the mitigating effect of multiple passes is unavailable to single-pass systems. Compounding this, for single-pass systems at high speed, problems might not be caught before significant output is ruined. Ideally, whether scanning or single-pass, systems should automatically detect and fix jetting problems on-the-fly. Luckily, imaginative new hardware and software techniques are emerging to both detect and correct print quality issues in near real-time.

The use of photometers or optical sensors to detect

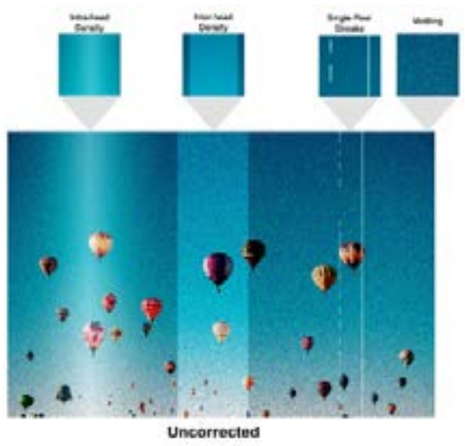
failed nozzles is not new. This technique is extremely effective at spotting small non-uniformities, even at high speeds. Because of the expense and complexity, it is most typically implemented in large systems. A much less expensive method to detect nozzle issues is showing great promise. This commercially available method uses printhead nozzle status feedback obtained via the electrical interface to the piezo drivers. This can be done at very high speed and real-time corrections can be applied automatically. A third technique, currently in the research stage, is to use pressure wave feedback through the fluid system to detect nozzle issues though the technical challenges associated with measuring tiny flow rate changes are significant but not insurmountable.

Beyond resolution of common jetting issues as previously noted, there have been recent breakthroughs in image correction techniques. One commercially available method is PrintFlat™ by Global Graphics Software. This powerful technique involves creating unique, printer-specific screens as a part of a print calibration process. These screens can then be applied to image data while still in the electronic datapath, thus compensating for varying print densities due to any number of physical causes. Advantages include the possibility of near real-time correction, density-based same plane compensation, interplane compensation, disabling of problematic nozzles and grey level compensation.

Another example of a commercially available compensation technology is NozzleFix™ by Meteor Inkjet. This technology uses good jetting nozzles to mask nearby deviated or missing nozzles. When poorly performing nozzles are detected, they are switched off and the datapath employs two compensation methods to recover. Same-plane compensation applies extra fluid from nearby nozzles which are in the same colour plane as the disabled nozzle. Inter-plane compensation applies extra fluid from nearby nozzles which are on different colour planes or an interlaced same colour plane.

> "The benefit of these new techniques"

The benefit of these new techniques can be quite striking for single-pass systems and is currently being implemented in applications including high-speed, single-pass label, textile, ceramic and book printers.



Uncorrected

Reliable jetting performance is dependent on the successful cooperation of substrates, fluids, printheads, drive electronics, transport systems, ink supplies and environment.

Corrected

For high-speed, single-pass systems, new techniques are increasingly available for detection and correction of problems and the rewards are immense.

About Meteor

Meteor Inkjet Ltd is the leading independent supplier of industrial inkjet electronics, software, tools and services. Working closely with all major industrial inkjet printhead manufacturers, Meteor offers production-ready solutions to printer OEMs and integrators worldwide.

July 2022

UK - Headquarters

Meteor Inkjet Ltd
Harston Mill, Royston Road,
Harston, CB22 7GG, UK
+44 345 8440012

Japan

K-Solution
1-14-8-9F, Fuchu-cho,
Fuchu-shi, Tokyo 183-0055
+81 (0)42-310-9717

Korea

Meson Co., Ltd
Room 701, Hanmaeum Plaza,
1076-8, Hyohaeng Road,
Hwaseong City, Gyeonggi-do
+81 (31) 2860768

China

Room 601, Red Dot City Building No. 1,
Lane 1809, Qixin Road,
Minhang District,
Shanghai
+89 139 1732 9079

USA

Global Graphics Software, Inc
5996 Clark Center Avenue,
Sarasota, Florida 34238
+1 (941) 924-7600

enquiries@meteorinkjet.com **www.meteorinkjet.com**

THE QUEEN'S AWARDS FOR ENTERPRISE: INTERNATIONAL TRADE 2019