

Our business units

Printhead

From the brightest, most textured ceramic tiles to the smallest, most complex printed electronics, Xaar's digital inkjet technologies are transforming print processes.

Key figures



● Industrial	46%
● Packaging	35%
● Graphic Arts	18%
● Royalty	1%

Printhead revenue

£35.3m

2020	35.3
2019	33.7

2020 summary

We made good progress with the new strategies for the Printhead business unit which we announced in April 2020.

[Read more on page 28](#)

We began to see the positive impact of the new business model introduced (only selling to OEMs and UDIs) with consistent new business wins. This has led to a growing mix of customers, both OEM and UDI, across a variety of industries beyond our more traditional sectors (Ceramics and Labels) to Aerospace, Automotive and Advanced Manufacturing.

The Xaar 2002 was launched in August. Developed using extensive customer feedback. The Xaar 2002 is being adopted by new and existing customers. The printhead incorporates drop in printhead alignment and tight mechanical tolerances to allow the printheads to be dropped into the printbar easier, making set up times faster, and machine builds quicker. In addition, thanks to its new advanced Tuned Actuator Manufacturing – TAM² – and Xaar AcuChp Technology, the Xaar 2002 also delivers visibly improved colour uniformity across the width of the printhead, further reducing printhead installation and set-up times, therefore maximising printer uptime.

The full launch of our ImagineX printhead platform took place in September, which provides a clear product roadmap for our customers and which will deliver some compelling advantages.

Priorities for 2021

A focus for 2021 is the Xaar Nitrox, launched in April 2021, and the second product offering from our ImagineX platform. As a very versatile, all round performer, this printhead, which offers a number of applications a 40% increase in productivity and more uniform print quality, is attractive to our Ceramics, Labels and Additive Manufacturing customer base in particular.

In China we are opening a Chinese office in Shenzhen to be able to deliver a higher level of service and enhanced technical support. The facility includes a demonstration centre, waveform development and RMA facilities.

We will continue focus on building our relationships with our OEM and UDI customers. This deeper working relationship is now facilitating Voice of Customer work to further develop our ImagineX platform product roadmap. In addition we are engaging with OEM and UDI partners on a number of product development programmes, with our partners committed to alpha and beta trials.

Where we excel

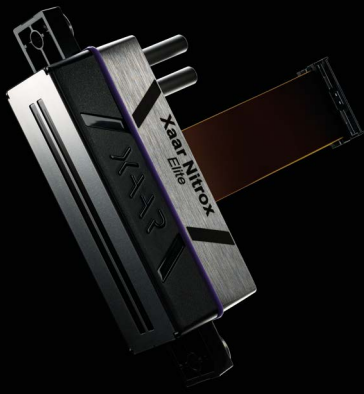
- We are the only truly independent inkjet technology company with 30 years of experience. Our independence enables a flexible, collaborative approach to ensure we remain customer-centric and focus on their goals
- State-of-the-art UK manufacturing facilities and an enviable R&D department staffed by scientists and engineers with a wealth of inkjet industry knowledge and expertise
- A comprehensive portfolio of printheads to cover a wide range of applications
- Engineers with extensive knowledge of inkjet and its application across many sectors as well as considerable field experience. This means they are able to assist our OEMs in the successful design, build, commissioning and post-installation support of all Xaar-based inkjet systems
- Ready-to-use development kits and an extensive portfolio of systems components ensures that OEMs can get up and running quickly.

Technologies

- TF Technology
- XaarDOT
- AcuDrp Technology
- High Laydown Technology
- Ultra High Viscosity
- Tuned Acuator Manufacturing
- XaarSMART.

[Read more on page 20](#)

| Our product range



Xaar Nitrox

With unparalleled productivity and performance, the Xaar Nitrox lets you create without limits



Xaar 2002

High productivity and out of the box exceptional print quality



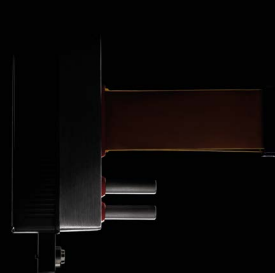
Xaar 1003 C

Ultimate versatility in ceramic tile decoration



Xaar 1003 U

All round reliable high quality printing for industrial applications



Xaar 1003 AMx

Highly accurate fluid deposition for additive manufacturing



Xaar 1003 AMp

Small drop deposition on an industrial scale



Xaar 501

High production up-time and industrial reliability



Xaar 502 O

Industrial reliability and mineral-oil free inks



Xaar 502 S

Exceptional print quality for Wide-Format Graphic



Xaar 128

Adaptable printhead with trouble-free integration

Our business units (cont.)

Printhead – Technologies

Xaar's unique inkjet technologies

We have a number of unique technologies which are incorporated into our printheads, and which provide distinct advantages to our OEM partners and their end user customers. Our leading technologies include:



TF Technology

Xaar's TF Technology is the original and still the best ink recirculation technology available. A printhead's architecture determines how well ink recirculation is implemented and therefore influences the degree to which the method delivers benefits across today's wide range of printing and jetting applications. Xaar's TF Technology, together with the unique Hybrid Side Shooter printhead architecture, enables ink or other fluids to flow directly past the back of the nozzle during drop ejection at very high flow rates.

This ensures the nozzles are continuously primed, keeping the printhead operational and the nozzles firing

and – with the ink in constant motion – prevents sedimentation and nozzle blocking, particularly in heavily pigmented inks. Any air bubbles and unwanted particles in the ink are also carried away, improving reliability, even in the harshest industrial environment.

This makes jetting significantly more reliable compared to alternative printhead designs where convoluted ink flow paths means that recirculation is close to, but not at the back of the nozzle.

The main benefits of TF Technology are unrivalled jetting reliability, outstanding print quality and an increased production uptime.

XaarDOT

XaarDot

Xaar's printheads cover three different drop configurations or three different modes of drop formation. Xaar's customers, therefore, have the flexibility to choose the right printhead for the application. XaarDOT ('Xaar Drop Optimisation Technology') encompasses

a range of drop formation options, each with specific features.

In a variable drop printhead, XaarDOT is incredibly flexible in giving customers the choice of what drop size or sizes to use for a job, both in terms of image quality and substrate flexibility.



AcuDrp

AcuDrp Technology delivers a number of advantages unique to Xaar including dynamic sub drop tuning for every nozzle in the printhead which helps minimise drop volume and drop speed variation

across the printhead, and from printhead to printhead. Therefore banding and colour density variations are minimised and changes in nozzle performance over time are managed effectively.



High Laydown Technology

Xaar's High Laydown Technology enables a range of new applications, thanks to its ability to deposit large quantities of fluid in each pass. It makes possible printing very high levels of UV inks or high build varnish in a single pass for tactile embellishments on labels, packaging and commercial print. Braille and label warning triangles are also possible. High Laydown Technology delivers unprecedented ink discharge rates for gloss and adhesive effects on ceramic tiles, so that effects can be printed at high line speeds.

For additive manufacturing applications, High Laydown Technology offers increased printing productivity which significantly accelerates build rate for parts and the ability to print a broader range of fluids including higher viscosity materials; this ultimately results in tougher 3D printed parts than those printed with standard inkjet technology.

Ultra High Viscosity

Xaar’s Ultra High Viscosity capability opens up a wide range of new inkjet capabilities and applications for OEMs and manufacturers using Xaar technology. Most printheads can only jet materials with viscosities of up to 10-25 centipoise (‘cP’). Thanks to Xaar’s unique TF Technology and innovative High Laydown Technology, fluids with significantly higher viscosities – up to 100 cP – can now be jetted.

The ability to lay down fluids with higher particle loading and particle sizes offers advantages such as an increased colour gamut, opacity and special effects. In addition, jetting higher molecular weight photopolymers for Advanced Manufacturing and 3D printing applications is made possible.

Tuned Actuator Manufacturing

Actuator performance in each printhead is optimised with Xaar’s Tuned Actuator Manufacturing. This process ensures full scalability with a simple and quick set up, streamlining printhead replacement, and achieves consistent print quality across long print bars with multiple printheads, at different greyscale levels.

XaarSMART

The Xaar 2001+ family of printheads incorporates XaarSMART technology which reports ink temperature and printhead status in real time so that printer performance can be easily adjusted to deliver consistent print quality throughout a production run.



Our business units (cont.)
Printhead – Focus on manufacturing



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Xaar's production processes are world-class and lead the way in inkjet manufacturing.

Our printheads are produced in a highly automated, cutting-edge factory in Huntingdon, Cambridgeshire which is ISO 9001 and ISO 14001 certified. Over 95% of Xaar's printheads are exported globally, with Asia, Europe and North America as the major markets.

Manufacturing on a micron and sub micron scale takes place in carefully controlled cleanrooms which have a total footprint of around 5,000m².

Initially, Xaar's printheads were manufactured in Sweden and in 2007 Xaar opened its UK factory. Since then we have invested over £70 million which gives us sufficient capacity to scale up the printhead business. Many of the machines used in the manufacturing process are bespoke as Xaar's processes have been built up from 30 years of highly specialised inkjet know-how.

In addition to manufacturing the printheads, we have specialist test areas for new developments as well as existing products, all of which go through a comprehensive print performance test before packing and shipment. In 2021 we will be opening a new customer demonstration centre to showcase the capabilities of our technologies.

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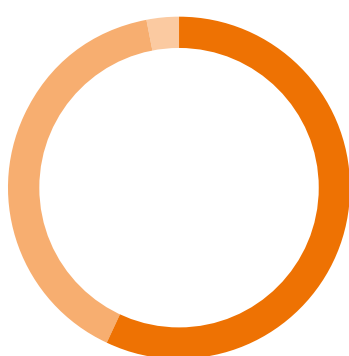
Our business units (cont.)

Product Print Systems

Introduction to the Product Print Systems business unit

Engineered Printing Solutions ('EPS') is a recognised leader in the industrial product marking machine industry, providing highly automated machines and accessories. As well as providing an industry-leading service and support, EPS occupies a niche position as one of only a few bespoke product marking machine companies in North America.

Key figures



- Digital 57%
- Analog 40%
- Other 3%

EPS revenue £m

£12.7m

Year	Revenue (£m)
2020	12.7
2019	15.7

Where we excel

Our core strengths are designing, building and integrating machines which allow our customers to product mark their parts in a highly automated manner, enabling significant cost savings and virtually unlimited print flexibility and personalisation. We offer unparalleled service and support which in turn ensures we build long-term relationships with our customers.

What we achieved in 2020

2020 was a challenging year for Engineered Printing Solutions due to the impact of COVID-19. Specifically, two of the company's key sectors – Ad Specialty and Promotional Goods – were hit very hard by the restrictions put in place to reduce the spread of the virus.

Whilst EPS saw a reduction in revenue year-over-year, we generated several long-term positive outcomes in improved margins, driven by cost cutting measures, improved lead times and the further exploitation of modular standardisation (by pre-building three core non-custom systems). This modular approach is starting to win orders.

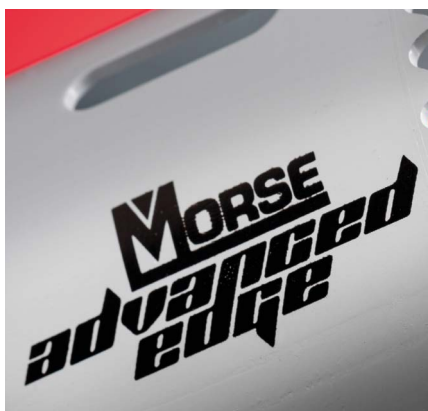
Outlook for 2021

We will continue to focus our strategy for the EPS business:

1. Business development aimed at utilising existing technologies to expand into adjacent markets;
2. Increased scalability through the standardisation of modular components whilst retaining the ability to meet each customers' unique requirements through customised fixtures and tooling; and
3. Deliver operational improvement to remediate management and financial controls, stock management, cost control and increased product margins.

Progress already made in business development is reflected in the strong order book and pipeline at the start of 2021 which contain opportunities from a number of new target markets.

Operationally, a key focus is the lead-time reduction initiative that will take the standard build times down from 26 weeks to 18 weeks to 12 weeks in two years.



EPS product portfolio

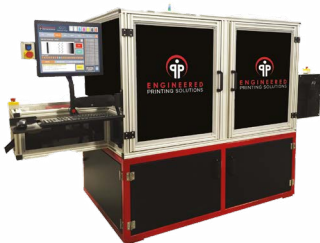
The EPS product portfolio major technologies:

In all three product portfolios, one of the key points that separates EPS from its competition is its ability to integrate and automate the product marking process. This includes robotic auto load and unload, part fixturing, part conveyance, pre-treating and post-print curing. EPS has designed and built standalone systems as well as drop-in integration solutions.



XD-360° Cylindrical Inkjet Printer

The XD-360° is a multi-colour, UV-LED, high-resolution industrial inkjet printer built specifically for decorating cylindrical objects. The XD-360° prints on flat walled or tapered cups and bottles with a synchronised printing and curing operation. Full WW+CMYK, optional primer and varnish heads are available.



F-Jet24 and Bottle Jet Digital Multi-Pass Scanning Systems

This technology is a lower cost, entry level approach to digital inkjet printing that is capable of producing high quality, high resolution images at a slower speed, but allows for image variability across multiple parts.



KP-KE Analogue Systems – Pneumatic Driven and Servo-Driven machines

Pad Printing employs machine heads, inks, silicone pads and clichés to produce a printed product. This technology is well-suited for long production runs that do not involve the changeover of artwork.



Our business units (cont.)

3D Printing

Introduction to the 3D business

Xaar 3D is developing 3D printing machines which leverage the benefits of industrial Xaar printheads.

These machines deposit a fine layer of plastic powder, onto which Xaar piezoelectric printheads print a high resolution cross-sectional pattern of the parts to be manufactured. Next, the complete powder layer is exposed to infra-red energy, causing the imaged powder to absorb this energy and fuse. This process is then repeated layer by layer until the whole build is complete. Unlike traditional laser systems, the Xaar 3D process is more consistent, controllable and cost effective.

Xaar 3D is an independent legal entity which comprises of Xaar 3D Ltd and Xaar 3D ApS. It is funded by investments from Xaar and Stratasys Solutions Ltd. The company's core strength lies in its capabilities and experience in machine design and development including powder management and thermal control, as well as years of experience in application and materials development for powder bed fusion. In order to maximise the revenue opportunity and expedite time-to-market for Xaar 3D's products, the Company has entered a partnership with global leading 3D Printing company Stratasys. In addition, Xaar 3D is working closely with materials suppliers and end-customers to assure the completeness of its product offering.

Where we excel

Our technical expertise in powder bed fusion is world-leading.

In addition our process and application team, including the technology's original inventor, bring unparalleled experience into the design of the product. The amalgamation of this knowledge has generated technology ideas under patent application and know-how that are capable of pushing the boundaries on industrial production via 3D Printing.

Our technologies

Our core technologies are predominantly based on unique implementation of a powder bed fusion process.

Inkjet printheads and infrared heaters are used to manufacture products layer by layer from polymer powder materials at much higher speeds than other additive manufacturing processes. Xaar 3D's Director of 3D Technology, Professor Hopkinson, is the original inventor of the core technology.



Our markets and opportunities

Xaar 3D is focused on enabling industrial production of products via 3D Printing.

CAGR of 3D Printing is approximately 23%* and the aspect to which we are focused, end part production – rather than prototype part production – is growing at a rate higher than the overall 3D Printing industry.

Stratasys partnership

In 2018 Xaar announced it would invest with Stratasys, the world's largest 3D Printing company, in a newly formed company, Xaar 3D Limited, to develop 3D printing solutions based on powder bed fusion. Xaar held 85% of Xaar 3D Ltd shares with Stratasys holding 15%. Subsequently in December 2019, Stratasys increased its investment in Xaar 3D to 45% with an option for Stratasys to acquire the whole of Xaar 3D within three years.

Progress update

During 2020 we manufactured commercially designed machines using our contract manufacturer partner.

With these first machines we completed our alpha programme in which we tested the commercial design and demonstrated that the machines are meeting our performance expectations and are capable of producing consistent end-use parts. We also completed the design and implementation of the workflow required for production of parts.

The successful completion of the alpha programme enabled us to ship the complete solution for further testing which also included a series of beta partners who specialised in the production of plastic parts in multiple target applications. Initial feedback from beta customers has been positive; therefore we are accelerating the beta programme during Q1 of 2021.

We are currently in advanced discussions for the disposal of our remaining stake in Xaar 3D as summarised in the strategy section (see page 11).

* Pira 2017.

