



AMCHEM

Engineering Solutions
for Business

THE COMPANY

Amchem was founded twenty years ago to meet the demanding engineering needs of the aerospace industry. Since then, Amchem has established itself as an acknowledged market leader in providing engineering and manufacturing solutions to the aerospace and other industries.

Wherever existing or planned processes prove inefficient or inadequate in meeting the demands of advanced applications, we should have an answer.

Amchem provides turnkey solutions through the design and manufacture of individual machines, multiple machines or automated machining cells, including all associated tooling. Solutions frequently involve combining sophisticated machine tools with other advanced equipment. However, each problem is unique and some may be resolved with a relatively simple machine configuration.

Unlike some similar companies, Amchem provides support at every level, from conception and design through to ongoing process control and complete factory communications. In Manchester Business School's view:

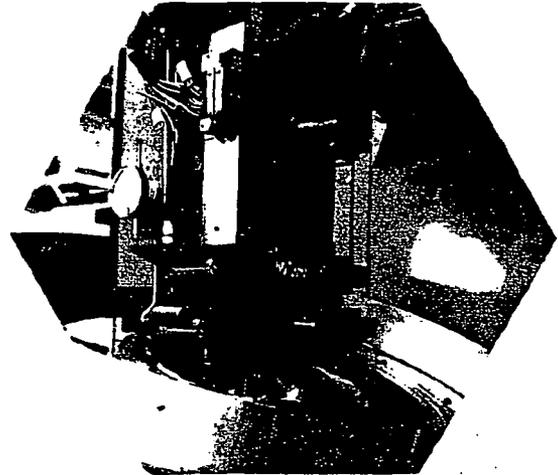
"Amchem is therefore selling a systems solution to a manufacturing problem, rather than an isolated piece of standard machinery with exclusive proprietary technology."

Amchem's success is due to its skill in using and uniting different technologies such as EDM, ECM, Laser, Computer Systems, Robotics Vision, Process Controls, Cell Management and Tooling. As a consequence Amchem has built an enviable reputation in advanced manufacturing systems.

Expertise

There could be no better evidence of Amchem's dominant technical expertise than the approvals received from major companies across the world. Those who have installed Amchem systems to enhance their production facilities include:

Aerojet
Alfa Romeo
Allison
Cummins
Famat
Garrett
General Electric
GKN
Lucas
Pratt & Whitney
Rolls-Royce
SNECMA
Volvo



Facilities

Amchem has every facility you would expect from a company dedicated to staying at the top of its field. Substantial investment is made to maintain the integrity of support services which include CAD facilities, quality inspection and laser measuring equipment.

The company complements its capabilities in manufacturing systems with a well equipped and highly skilled toolroom. This gives Amchem the ability to provide a complete package and to respond immediately to ongoing requirements for spares and modifications.

Continual research and development are crucial for any company determined to stay a market leader. Amchem's internal R & D programmes are supplemented through collaboration with universities and other institutions throughout the United Kingdom.

Support

Amchem's philosophy is to provide **total** support, which does not start and end with the purchase of a machine. We will support your decision making process at conception, support your engineers at implementation and provide ongoing support after commissioning. For many customers our support extends into related fields of process and plant integration, engineering for new products and advice on improving productivity.

Amchem's training department provides comprehensive instruction covering all aspects of our equipment and all types of user, from the unskilled operator to the highly skilled programmer. Of course, our support does not stop there. Our technical staff are always on hand to offer advice and assist with enquiries on any aspect of system programming and operation.

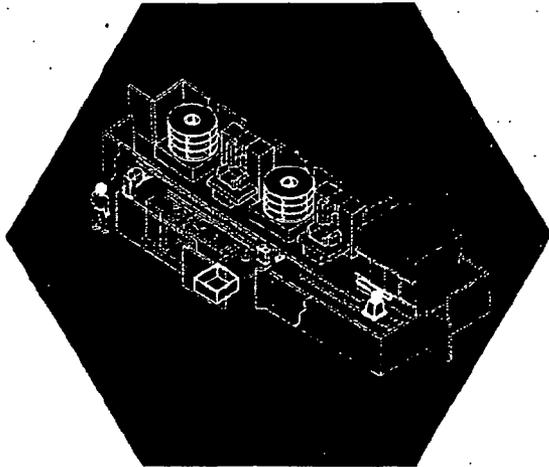
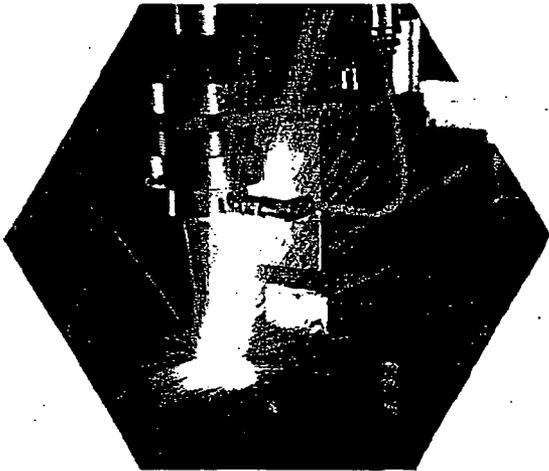
Standards

Amchem equipment is tailored to a customer's needs, from the specification of the machine and tooling to integration with existing plant and processes. If one of our standard machines does not solve a customer's problem, then we have the expertise and commitment to design a specific solution.

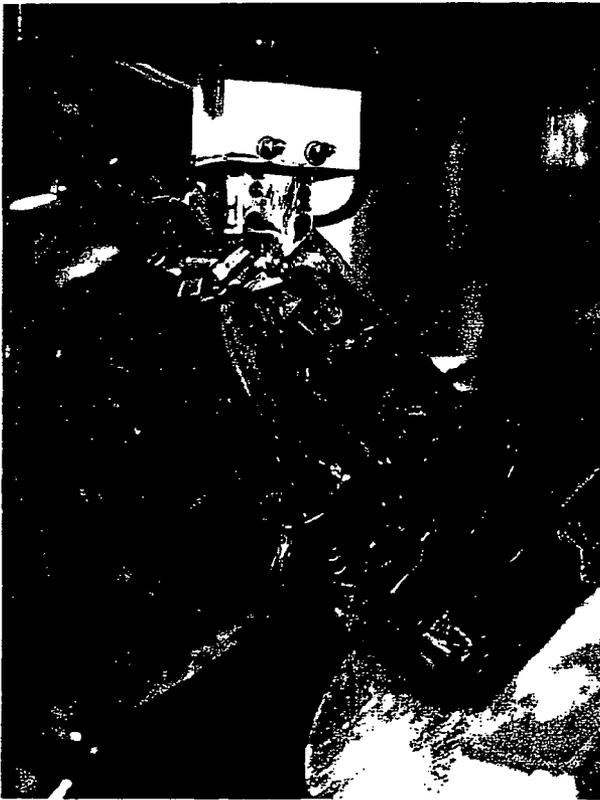
Where applicable, our standard systems are produced to the following specifications:

Linear accuracy	+/- 0.0005 inch (+/- 0.013mm)
Linear repeatability	+/- 0.0002 inch (+/- 0.005mm)
Rotary accuracy	+/- 10 arc seconds
Rotary repeatability	+/- 5 arc seconds

All Amchem generators are controlled by either CNC or PLC and all wire electrode bearing systems have automatic refeed capability.



ELECTRICAL DISCHARGE MACHINING



An EDM head on a VM2 machine cutting cooling holes in an aeroengine part

The EDM process uses an electrical discharge between an electrode tool and an electrically conductive workpiece immersed in dielectric fluid to vaporise a small volume of the workpiece. By adjusting the energy and frequency of the discharge and the gap between the tool and the workpiece, the volume of metal removed and the consequent surface finish can be finely controlled. Production EDM is continually finding new applications where its ability to cut small deep holes, produce complex shapes and achieve very accurate tolerances in hard metals is invaluable.

Typical Applications

A sequence of five operations to manufacture multi-shaped cooling holes are performed on a turbine vane by the Amchem VM2 machine. The utilisation of twin EDM heads with 5 axis CNC control and twin 6 station electrode tool changers has enabled our UK customer to achieve a payback of less than 12 months.

VM2 machines at a US company produce strip seal slots in nozzle guide vanes and shroud pockets on turbine blades.

For a European customer a closed loop facility has been established between an Amchem vision inspection machine and a VM2 machine which manufactures over 60,000 cooling holes in a combustor ring.

Fibre extrusion modules requiring many thousands of holes are manufactured economically by the automated refeed M25 machine.

VM Machining Centres

For machining complex shapes or holes in small to medium sized components, for example turbine vanes and combustor rings, with full CNC control.

Up to six axes.

One or two machining heads.

Up to two multi-electrode cartridge changers.

Up to six different operations can be performed automatically on each head.

Closed loop machining.

Work area: 18 x 18 x 18 inches (450 x 450 x 450mm).

M2S Machining Centres

For drilling and forming operations on small components similar to the VM range, but up to three axes with CNC control.

Wide range of production line configurations possible.

Single, twin or multi-head arrangements.

Single or multiple electrode cartridges.

Variable work area.

Microhole Machining Centres

For machining holes below 0.01 inch (0.254mm) with or without full CNC control.

Very accurate diameter control, 0.0001 inch (0.00254mm).

Closed loop flow control.

Up to 5 axes.

Variable work area.

Ideal for injector nozzle manufacture.

RD Machining Centres

For large circular components such as combustor liners, fully CNC controlled.

Up to four axes.

Up to 9 heads operating simultaneously.

Closed loop machining.

Work area: 18 x 33 inches (450 x 850mm).

EDG Machining Centres

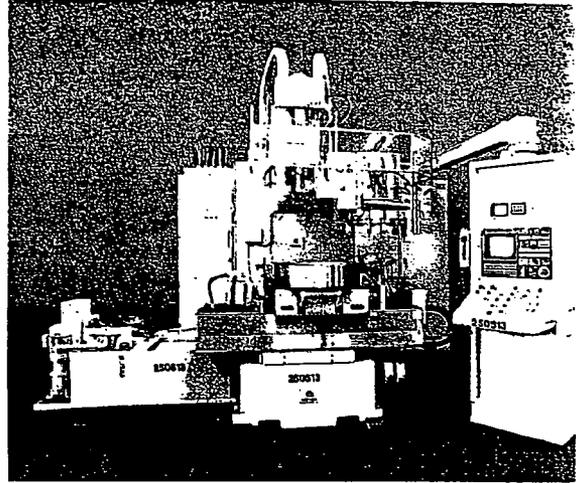
Combining accuracy and speed of grinding with low machining forces of EDM, fully CNC controlled.

Ideal for machining honeycomb materials.

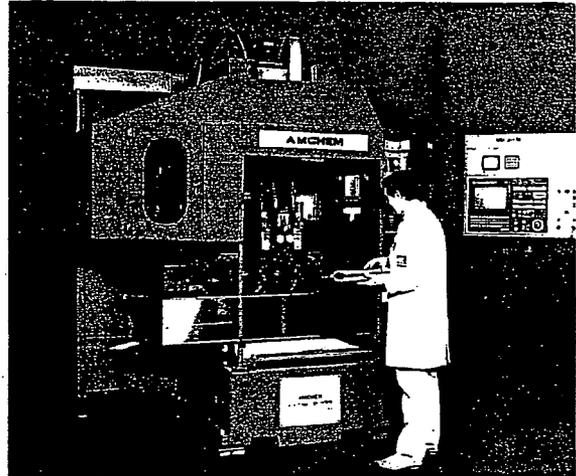
Up to four axes.

Closed loop machining.

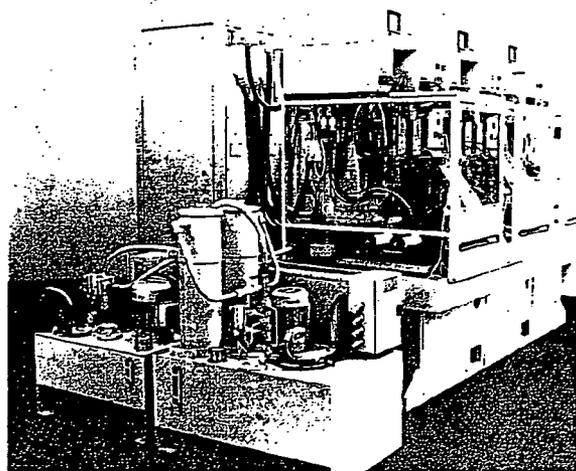
Work area: 18 x 33 inches (450 x 850mm).



A VM2H machine for Allison with single 5 axes table.



A twin six axes VM2A machine for Rolls-Royce during inspection at Amcher



A three head M2S system for Pratt & Whitney.

ELECTRO-CHEMICAL MACHINING

ECM is a versatile process for producing complex shapes in hard metals, drilling small deep holes, deburring and grinding. A voltage is applied to an electrode tool which is advanced at a controlled rate towards an electrically conductive workpiece. An electrolyte passes between the tool and the workpiece and metal is removed by electro-erosion, establishing a stable gap in front of the advancing tool.

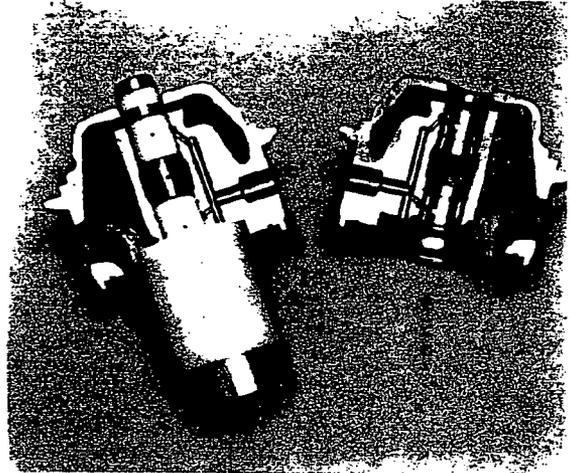
Typical Applications

Amchem ECM equipment is used by a leading US manufacturer of aircraft engines to grind engine stators. The fragile components are subjected to very low forces by the operation which meets high tolerance specifications.

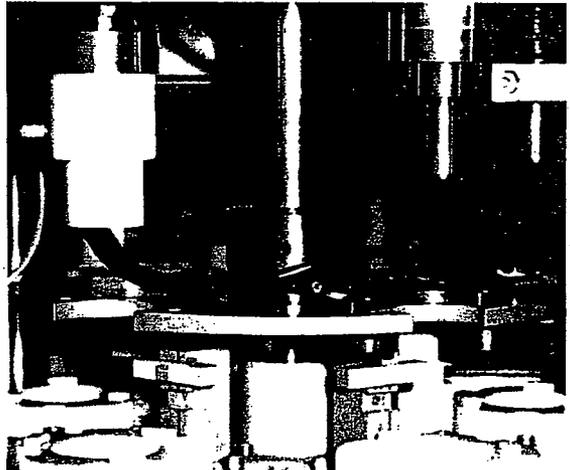
A UK manufacturer uses a capillary drill cell for deep hole drilling of turbine blade components, which are first subjected to ultrasonic measuring and then checked using vision inspection.

ECM is recognised as an excellent process for deburring relatively inaccessible intersections and cavities in cast or machined components. Recent applications have been on turbo charger bodies, gears and fuel injector bodies.

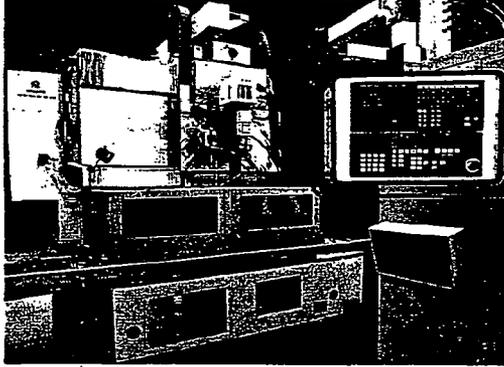
Complex shapes can be formed relatively simply by using the ECM process. Our technology can be used in the manufacture of forging dies, compressor blades and blisks.



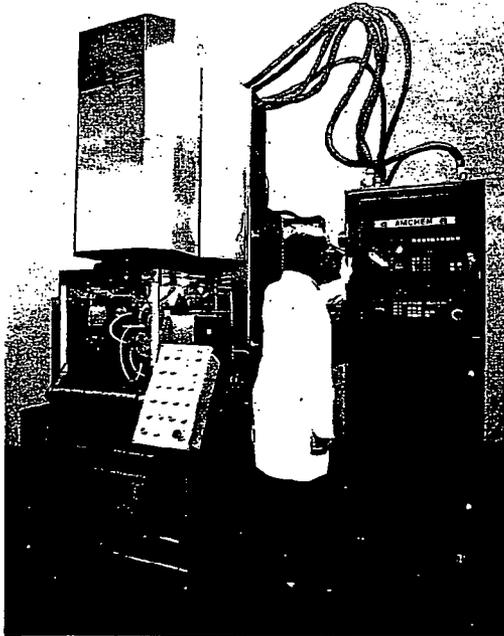
An EC deburr tool and cutaway section of the workpiece, a turbocharger body.



An EC deburr machining head in operation.



EC grinding machine for Allison Gas Turbines.



A five axes Capillary Drill undergoing final trials for Rolls-Royce.

Acid Drills

For machining accurate deep holes in small to medium size components, with full CNC control.

Processes include capillary, electrostream and stem drilling.

Holes down to 0.010 inch (0.254mm) diameter and in excess of 0.5 inch (10mm) deep.

Up to five axes.

Closed loop machining using ultrasonics for detecting cavities.

Robotic cells with integrated electrolyte systems.

Workspace: 8 x 8 x 2 inches (200 x 200 x 50mm).

EC Grinding Machines

For accurately grinding fragile and sensitive components to high tolerance specifications.

Up to four axes available, with CNC control.

Work area from 36 x 18 inches to 72 x 36 inches
(900 x 450mm to 1800 x 900mm).

Grinding to within 0.001 inch (0.0254mm).

Automatic wheel compensation after dressing.

EC Forming Centres

A simple means of machining complex shapes with full CNC capabilities.

Up to five axes.

Systems from 200 amps to 40,000 amps.

Single or multi-head versions.

Variable work space.

EC Deburring Machines

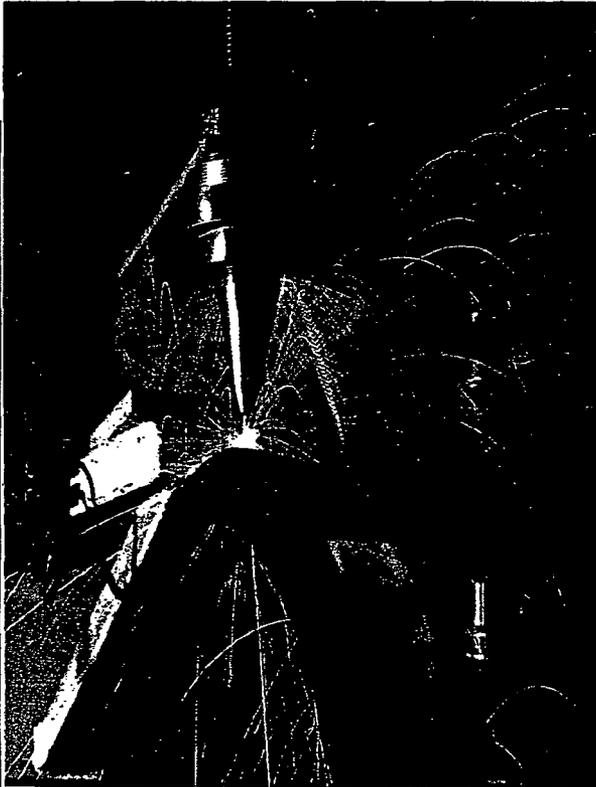
An efficient means of cleaning otherwise inaccessible areas of a component with varying degrees of engineering sophistication.

Systems ranging up to 4000 amps.

Manual or fully automatic versions.

Multistation capability.

LASER PROCESSES



A YAG laser system drilling on the fly.

Laser light is produced in the form of a beam that has a very low divergence. The near parallel nature of the beam allows the light to be focused on such a narrow spot that an intense concentration of energy is produced.

Amchem uses independently sourced YAG and CO₂ lasers in its systems. YAG lasers are suitable for drilling deep holes and for cutting and welding hard metals. CO₂ laser systems are suitable for high speed cutting applications.

Typical Applications

When Amchem designed a laser cutting system for a high volume component manufacturer in the UK automotive industry, the customer achieved new standards of accuracy, quality and output, demonstrating major advantages over conventional punching and broaching techniques. The customer also gained the opportunity to improve the production line flow and reduce the required production workspace.

For a major US manufacturer of aero engines Amchem provided a laser drilling system to increase the production and finished quality of combustor rings. On components requiring thousands of precise and burr-free holes this technology provided the customer with an efficient and highly productive solution.

Techniques developed by Amchem allow holes to be drilled at rates of up to 5 per second (process time) in "effusion" or "pepperpot" format.

Laser technology meets the demands of both aerospace and surgical industries for quality in precision welding and drilling of sensitive products.

Automotive and hydraulic component applications (such as lubrication holes) assembled on fast flowing production lines are suited to laser drilling/cutting techniques which can eliminate the need for subsequent deburring processes.

Amchem Laser Systems

Amchem can offer purpose built systems (GP Systems), designed to meet very specific manufacturing and/or process requirements. Alternatively one of our standard configurations may provide a cost effective and timely solution.

Amchem laser systems are equally suited to either YAG or CO₂ resonators.

LD Systems

A range of machines of robust construction designed to meet the requirements of laser machining small to medium size components, such as aero engine blades and vanes or small combustor liners.

Full CNC control of laser parameters.

Three linear axes of stroke: 18 × 18 × 18 inches
(450 × 450 × 450mm).

Optional 4th and 5th rotary axes available.

Drilling on the fly.

Twin machining configuration available to increase laser utilisation.

Auto focusing, trepanning and through the lens TV available as options.

LMC Systems

A range of machines designed to cope with larger components such as sheet metal work and large combustor liners.

Full CNC control of laser parameters.

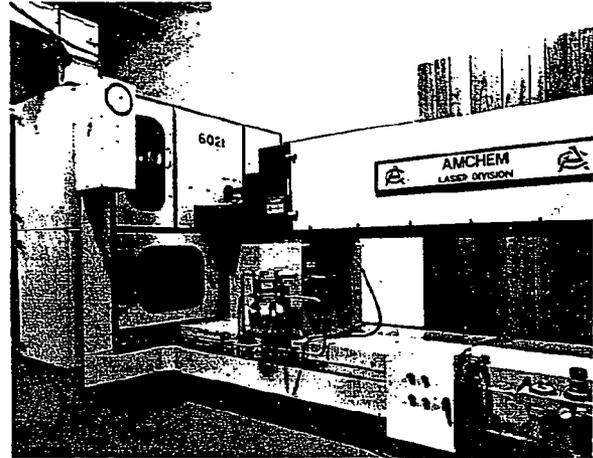
Drilling on the fly.

X, Y stroke of 40 × 40 inches (1000 × 1000mm).

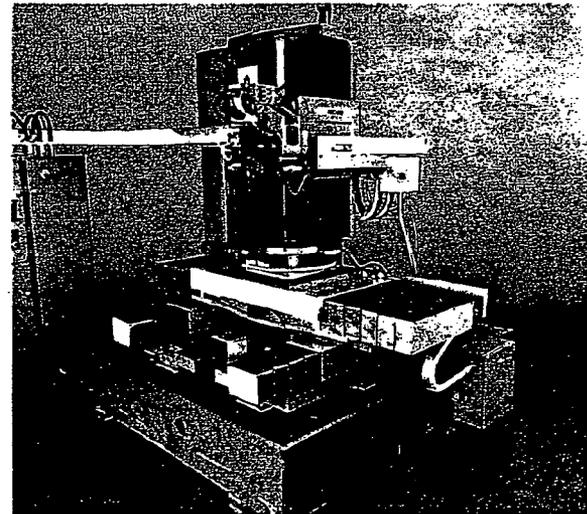
Z axis stroke up to 44 inches (1100mm).

Up to 3 additional rotary axes available.

Auto focusing, trepanning and through the lens TV available as options.



A five axes CO₂ laser system for GKN.



A YAG system for drilling holes in combustor liners for a US manufacturer.

VISION TECHNOLOGY

In vision technology, the image received by a closed circuit TV camera is processed to produce a digital representation of the picture.

This is achieved by dividing the picture into a matrix of small cells called pixels (picture elements). Data diffusing the brightness is then stored for each element within a digital memory bank called a frame store.

The data thus stored is then readily accessible to a computer which may process and analyse it to determine dimensional and qualitative features of the image.

The advantage of vision technology is that inspection facilities can not only check often complex and sophisticated components, but this can be performed at very high speed without degradation in quality. Furthermore, by using closed loop facilities, the vision machine is capable of correcting machining errors. Consequently when appropriately used, vision equipment can have a significant impact upon productivity.

Amchem Vision Systems

Amchem has gained a wide knowledge of vision inspection techniques through its involvement in the demanding aerospace industry. Our engineers would be pleased to consider any application where vision may be appropriate, giving an honest opinion of its feasibility and the equipment best suited to solve the problem.

Typical Applications

For a major European aero engine manufacturer Amchem has manufactured a suite of EDM machines producing holes in large diameter parts.

The inclusion of a purpose built vision machine within the cell has enabled, for the first time, every hole to be inspected for area, size and position.

Feedback from the vision machine to the EDM machines has enabled a much closer tolerance on hole area to be achieved.

For a US repair facility, Amchem manufactured an EDM/Vision machine capable of inspecting part repaired engine components to determine the position of missing holes.

The vision system instructed the machine where to drill these holes relative to existing holes on the part.

The addition of vision capability to a large laser machine delivered to the USA enabled both auto focusing of the laser and the ability to post-inspect the holes produced.

Amchem has also worked with customers to provide solutions to problems in the following areas:

- Profile management
- Seam tracking.
- Slot depth and width measurement.
- Feature location.

Closed loop vision inspection supplied to Alfa Romeo as part of a machining cell.



Amchem vision inspection machines are not only supplied as part of an Amchem machining centre or cell. They can just as easily be designed to fit into existing production configurations manufactured by other suppliers for a variety of industries with either high or low production volumes. Amchem vision systems provide an economic and efficient inspection facility which can greatly improve manufacturing productivity.

INTEGRATED SYSTEMS

The successful application of manufacturing processes may require integration of tooling, fixtures, part handling and inspection equipment with the logistics of production.

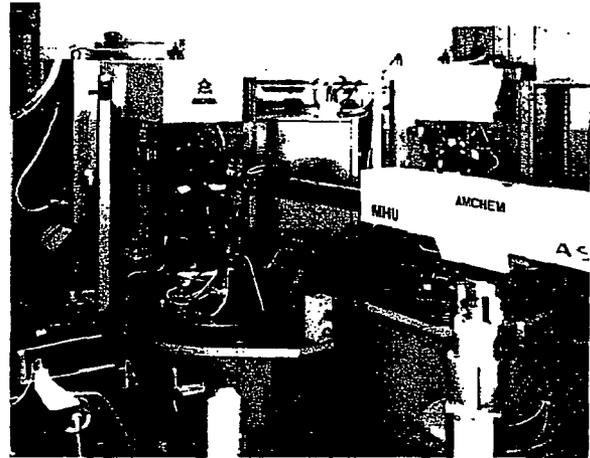
Amchem undertakes the specification, design and supply of systems to enable full process efficiency to be achieved. This extends to the supply of CIM, DNC and integrated cells complete with robotics.

Amchem is increasingly undertaking the design and supply of process control systems integrated with in-house design, manufacture and quality control facilities with the objective of improving productivity and control.

Typical Applications

A major systems installation by Amchem included a cell of 3 Amchem EDM machines that are supplied with components and electrodes by robot. Component and electrode storage is integral to the cell together with the inspection and quality control system, which is based upon an Amchem automated vision inspection machine on a closed loop.

A laser cutting machine was designed and built by Amchem to be inserted into a new production line. The priorities were that the part flow rate was maintained and that the equipment would integrate with other suppliers' machinery feeding the parts and taking the finished item. The completed production line is now a showpiece of advanced production line technology.



Part of a robotic EDM, ultrasonic cleaning and inspection cell integrated into a production line at Rolls-Royce.

CONSULTANCY

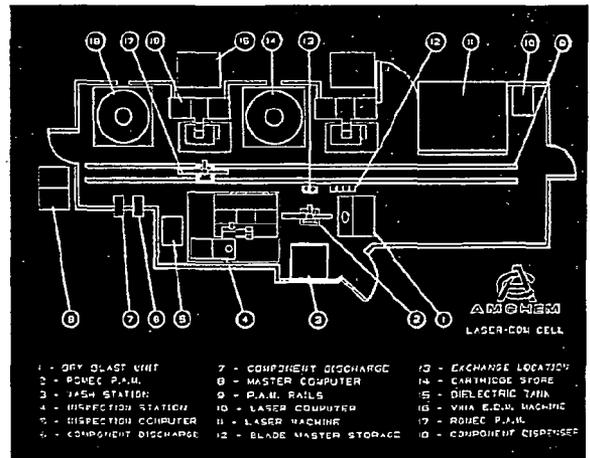
Many customers simply seek advice.

It may be required for long term planning and strategy, or to supplement an internal feasibility study. Over the years Amchem has drawn upon its own experiences and knowledge of engineering technologies to provide consultancy support to a variety of companies and organisations worldwide, from recognised heavy engineering companies to those on the very periphery of an industry or supporting it.

Two recent examples of Amchem's consultancy work demonstrate the versatility and ingenuity of our support.

A manufacturer of photographic film approached us to improve the quality of film cassettes by perfecting a method of cutting the composite materials. We investigated and identified the cause of the problem and then designed and developed a practical solution that could be incorporated into the existing production line.

An international aircraft engine manufacturer asked Amchem to design and prepare a specification for a fully automated EDM cell to manufacture turbine segments. This included integration with the existing flow process and computer aided manufacturing systems. The finished document was used by the company as part of a submission to Government for project support.



A CAD representation of a study to integrate laser and EDM process, together with cleaning and inspecting, for a US aeroengine manufacturer.

This brochure gives a broad outline of Amchem's services to industry and the technologies for its disposal. However, as Amchem meets new challenges, the boundaries of the company's capabilities are continually expanded. These cannot always be reflected in a brochure, particularly since the majority of Amchem's work is sensitive either for defence reasons or because it generates a competitive advantage.

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