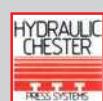




Special Purpose Machinery For the **Aerospace** Industry



Company Introduction



Group Rhodes offers 190 years of experience in the manufacture of special purpose mechanical and hydraulic presses for metalforming applications around the world.

All major research and development work is conducted in-house and is supported by a well-equipped Computer Aided Design Department covering mechanical, electrical, hydraulic and software engineering disciplines. The company operates from four sites in the United Kingdom, and boasts excellent fabrication, machining and fitting departments. All aspects of machine build are controlled to Rhodes quality and safety standards which have achieved international (ISO) and European (CE) certification.

The Company actively manufactures and markets over fifty basic product ranges, although pride is taken in the ability to design, develop and manufacture bespoke machinery and complete turnkey solutions.



Main (left): Aerial photograph of the Company's 30 000 sqm head office site in Wakefield and other UK sites.

Top: Group Rhodes has a comprehensive machining facility which can accommodate components weighing up to 40 tonnes.

Bottom: The technical design department utilise Autodesk Inventor, Solid Works, and CATIA 3D design packages

Below: The fabrication division offers TIG, MIG and MMA welding to ISO1561-1 + ASME 9 standards; Flame Cutting; Shot Blasting; Stress Relieving and Sub Arc Welding.



Aerospace Product Range



Above: Rhodes SPF presses are used to produce components for civil and military aircraft.

Application examples:

Main (right): Jet engine hollow wide chord fan blades

Top: Exhaust bay doors for the F35 JSF

Bottom (left): Jet engine exhaust assemblies

Bottom (right): Jet engine exhaust manifolds

Below: Canard wings

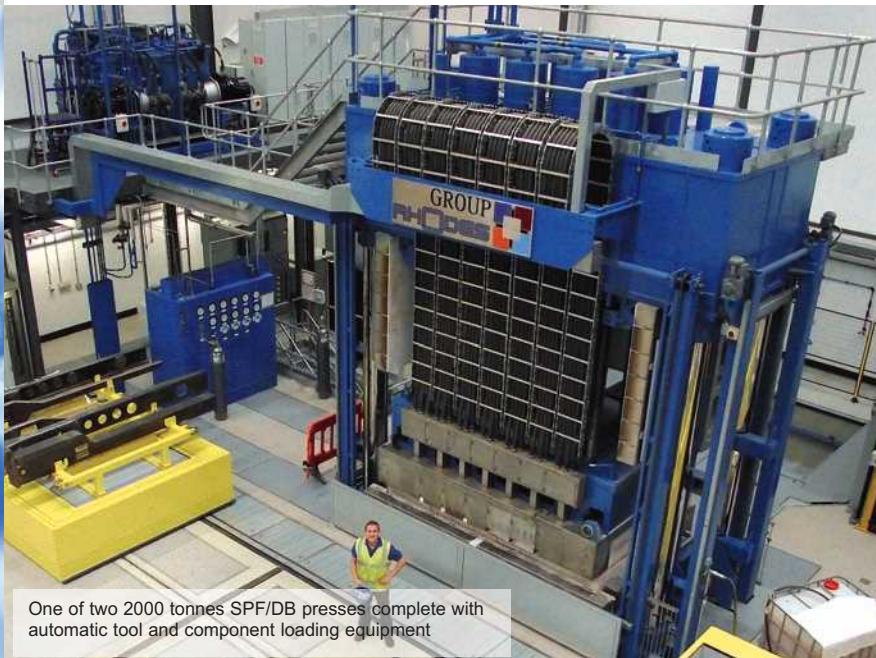
A major part of the Company's portfolio is an extensive range of machinery dedicated to the aerospace industry. This includes precision presses, autoclaves and advanced automated handling systems for the specialist forming of aluminium and titanium alloys into strong complex yet lightweight structures

The Group Rhodes aerospace product range includes:

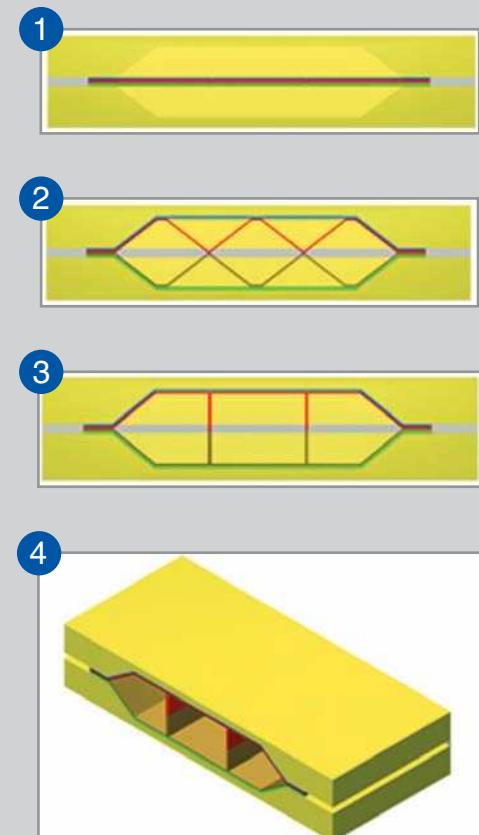
- Superplastic Forming and Diffusion Bonding Presses
- Flexible Die Presses
- Dualform Presses
- Composite Moulding Presses
- Autoclaves
- Hot Joggling Presses
- Three-Point Bending Presses
- Stretch Forming Presses
- Advanced Automation/ Robotics



Superplastic Forming & Diffusion Bonding Presses



Stages of the SPF/DB multi sheet forming process



DESCRIPTION

Group Rhodes (incorporating John Shaw and Chester Hydraulics) has continually been at the forefront of designing and manufacturing SPF/DB presses since the mid 1970's. Today, Group Rhodes is the only UK Company, and one of only a few operations in the world capable of developing commercially available automatic SPF/DB presses. International sales success demonstrates that the company continues to be at the forefront of the design and manufacture of this innovative technology.

Superplastic Forming (SPF) offers engineers a method of accurately forming, single or multiple sheets of titanium into extremely complex, accurate, deep drawn shapes. The process involves heating the component sheet to a specific, accurately controlled, temperature and forming the sheet, or multiple sheets, into a mould cavity or over a male former by the application of controlled gas pressure.

The process greatly reduces the formation of rippling, tearing and thickening of components, which usually occurs when they are cold formed.

Finished Component

Superplastic Forming & Diffusion Bonding Presses



Main (right): 1400 tonne SPF/DB press complete with semi-automatic tool loading equipment

Above: Open press daylight at 1000 degrees centigrade

Below: 1650 tonne SPF aluminium forming press



Diffusion Bonding (DB) is a joining process achieved by the application of load at elevated temperatures. The resultant molecular bond offers a fully homogeneous joint, which, in many cases, is undetectable under microscopic examination.

THE BENEFITS

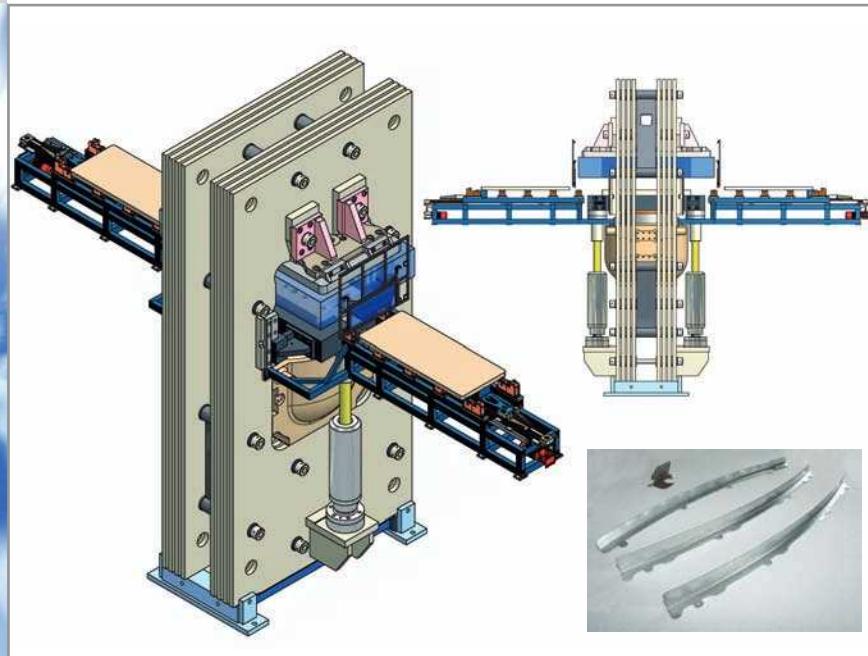
The SPF/DB process offers freedom to produce more complex, stiffer, stronger and lighter structures in one piece thus giving improved component integrity. By producing more cost effective manufacture and lighter components typical savings of 30% in cost and 20% in weight are achievable.

TYPICAL PRODUCTS PRODUCED

Engine fan blades, outer guide vanes, exhaust structures, canard wings, fuselage panels, wing leading edges.



Flexible Die Presses



DESCRIPTION

Group Rhodes is a world leader in the manufacture of Flexible Die Presses with a prestigious customer base.

The basic principle of operation of a Flexible Die Press is to drape a component sheet (usually aluminium) over a male former loosely positioned on the upstroking press table. Hydraulic pressure forces the male former (complete with the component sheet) into a multi-layered flexible polymer pad. Housed within a robust structure within the press, the polymer pad offers various die flow characteristics effectively becoming the female die.

THE BENEFITS

Simple low cost tooling, for producing multiple high volume components.

TYPICAL PRODUCTS PRODUCED

General aircraft brackets and stiffener sections.

Main (left): The latest design packages are utilised in the manufacture of the Flexible Die Presses

Main (left inset): General Aircraft Brackets and Stiffener sections produced on a Rhodes Flexible Die Press

Above: 10600 tonne Flexible Die Press under construction

Below: 10600 tonne Flexible Die Press completed on site



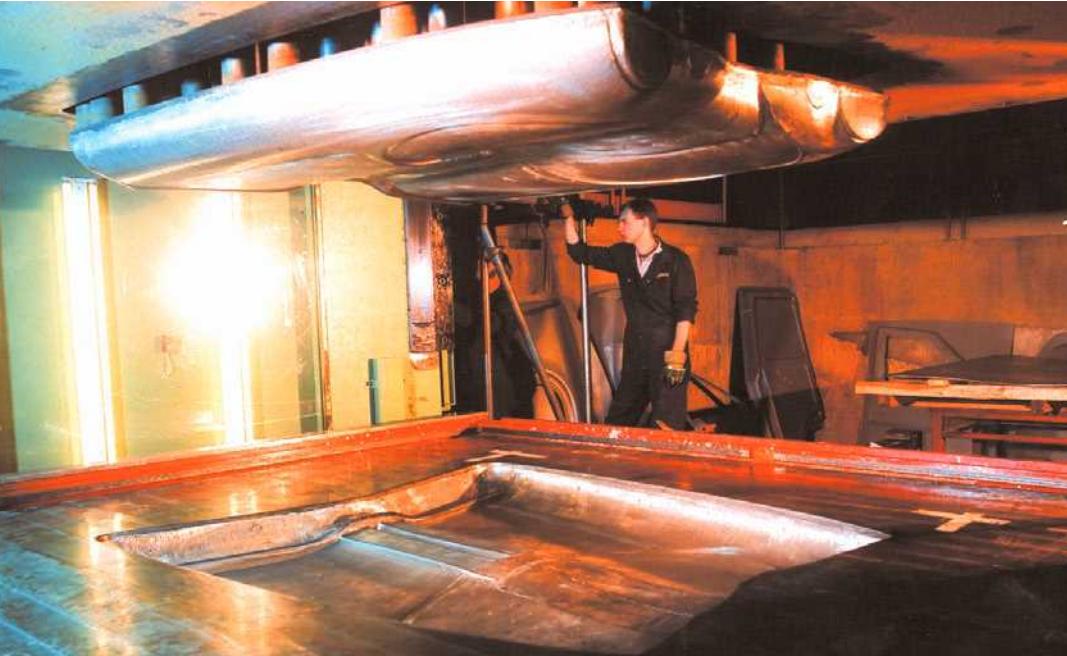
Dualform



Main right: Top and bottom tools manufactured in the Dualform Model 9 press ready for pressing panels.

Above: Dualform Model 9 press under construction

Below: Dualform Model 6 press with manufactured aerospace components.



DESCRIPTION

Dualform is a patented process incorporating a special Double Acting Hydraulic Press. This process enables the simultaneous manufacture of matched top and bottom dies within the press, which in turn are used for the manufacture of finished pressed panels. More than 250 Dualform presses have been sold worldwide.

Dualform tools are cast using a unique, low melting point, alloy called 'Jewelite', housed in a special bath situated within the press toolspace. After use, the tools are melted down in situ and new tools are cast. The process can be completed in approximately 3 hours on the smaller presses and under 24 hours on the larger Dualform models. The operation can easily be repeated for each new (or repeat) batch of pressed components.

THE BENEFITS

Minimal tooling costs and quick tool manufacture ensures that Dualform is an extremely cost effective method of prototype engineering and low volume production

TYPICAL PRODUCTS PRODUCED

General aircraft panels



Composite Moulding Presses



DESCRIPTION

Group Rhodes has a successful history of manufacturing Thermal Fluid Heated Hot Platen Presses. The platens are constructed from solid plate as opposed to fabricated construction, to ensure a high resistance to thermal distortion and thermal shock. The supporting platen structures are fitted with excellent thermal insulation together with additional water cooling plates, which eliminate any residual heat being transferred into the press structure.

THE BENEFITS

Group Rhodes composite moulding presses offer manufacturers an extremely accurate temperature and flatness platform to accept tooling or flat panel products.

TYPICAL PRODUCTS PRODUCED

Helicopter rotor blades, aircraft floor panels, bulk head panels, interior honeycomb structural panels and aircraft engine casings.

Main (left): Composite helicopter main rotor blade

Above (top): Composite Sheet Panel Press
(multi Daylight)

Above (bottom): Composite Hot Platen Press

Below: Composite Two Stage Tile Press



Autoclaves



Main (right): Composite autoclave used for the winning Bentley at Le Mans 2003

Above (top): Specialist composite autoclave for educational training

Above (bottom): F1 model shop autoclave

Below: Engine casing assemblies



DESCRIPTION

Rhodes autoclaves produce precision engineered composite products for leading aerospace manufacturers worldwide. Fabricated utilising the latest welding techniques and highly sophisticated computerised control systems, Rhodes Autoclaves achieve precise three dimensional, uniform pressures to enable the production of an infinite variety of shapes and sizes. The autoclaves offer fully programmable control of temperature, pressure, vacuum and process functions supported by comprehensive monitoring and data logging facilities.

THE BENEFITS

The ability to produce an infinite variety of complex shaped components.

TYPICAL PRODUCTS PRODUCED

Engine casings, wing panels and fuselage panels from a variety of composite materials.



Hot Jogging Presses



DESCRIPTION

As one of a few companies in the world capable of manufacturing Hot Jogging Presses. Group Rhodes machines are typically used to form "hot joggles" in aluminium alloy extruded section stringers. The stringers are used as fuselage panel stiffening members, which are extensively fitted on lightweight aircraft such as the Bombardier Learjet aeroplane.

Group Rhodes Hot Jogging presses are available up to 50 tonnes. They are usually down-stroking C-frame forming presses complete with accurately heated die sets. The die set, which operates at 180 Deg C, is capable of accepting a range of tooling inserts to accommodate various extruded profile sections. The presses are also fitted with an integrated adjustable stroke stop assembly as a means of accurately locating the joggle from a predetermined datum. The accuracy of the stroke stop assembly guarantees joggles are positioned to within 0.05 mm.

THE BENEFITS

Provides the accurate manufacture of stringer sections, essential for lightweight aircraft production.

TYPICAL PRODUCTS PRODUCED

Aircraft stringer components.



Main (left): light aircraft utilise joggle stringer sections for their enhanced design and strength to weight ratios

Main (left inset): typical joggle stringer sections

Above: 50 tonne Hot Jogging Press

Below: Internal stringer section framework



3-Point Bending Presses



Left (top): Fixed Jaw Sheet Stretch Forming Press

Left (bottom): The Hawk Trainer includes panels manufactured on Rhodes 3-Point Bending Presses and Stretch Forming Presses.

Above: Rhodes 80 tonne down-stroking 3-point Bending Press

DESCRIPTION

The 3-Point bending machine is an hydraulic press capable of applying 80 tonne point load across a component sheet. The upper pressing anvil can be positioned left-to-right across the width of the press and is fitted with accurate vertical positional controls.

THE BENEFITS

The press is utilised for cold forming detail work to aluminium aircraft panels.

TYPICAL PRODUCTS PRODUCED

Fuselage panels and wing panels.

Stretch Forming Presses

DESCRIPTION

Rhodes stretch forming machines allow the cold forming of aluminium sheet components with minimal spring back. This process involves the sheet being stretched to its yield condition and then draped over a male forming tool.

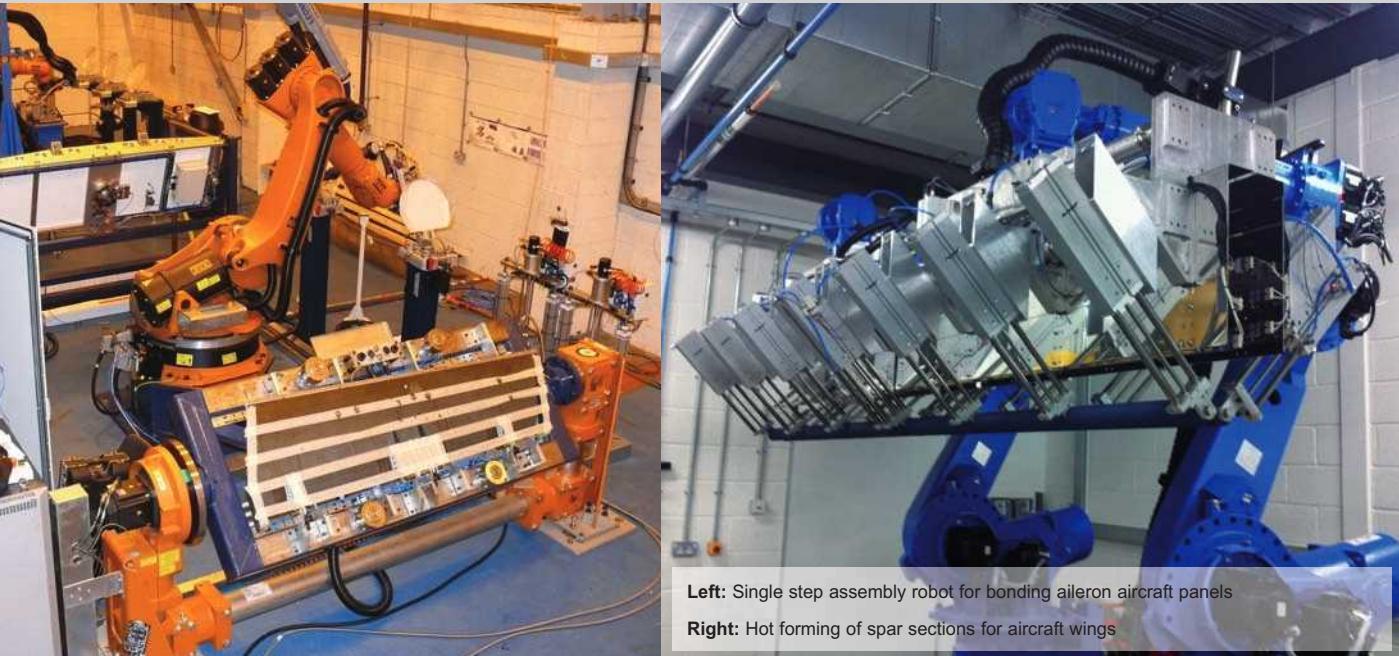
THE BENEFITS

Reduced spring back enabling accurate profiles to be manufactured.

TYPICAL PRODUCTS PRODUCED

Aircraft fuselage and wing panels.

Advanced Automated Handling



DESCRIPTION

Group Rhodes provides a full suite of design services plus numerous turnkey automated solutions. These include sophisticated jig fixtures, remote handling, robotic cells with transfer systems, tooling verification systems with remote diagnostics and automated flow lines.

From simple robotic cells and bespoke 5-axis machine tools to sophisticated test equipment, Group Rhodes offers solutions that ensure customers receive the appropriate level of process automation.

THE BENEFITS

Increased efficiency and production

TYPICAL PRODUCTS PRODUCED

- Automated Robotic Systems
- Robot & PLC Programming
- Optimisation process through simulation



Data provided in this literature is an approximate guide and shall not be contractually binding. The policy of Group Rhodes is one of continuous product development. The right to change specification and design at any time without notice is reserved. 0.1M/1113/A

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