



On a wing

To celebrate the maiden flight of the Airbus A380 we look at the role BFPA member company Bosch Rexroth played in getting the craft off the ground

The 27th April 2005: The first Airbus A380 to take to the air lands at Blagnac international airport in Toulouse after successfully completing a maiden flight that lasted three hours and 54 minutes. The A380's first flight was jointly captained by Claude Lelaie, senior vice president Flight Division, and by chief test pilot and vice president Jacques Rosay. After landing, the crew confirmed that the new aircraft and engines had handled as anticipated.

Claude Lelaie commented: "We had a very successful first flight and thoroughly enjoyed every minute of it. There are of course a lot of things to be done, but after this first experience, we now really sense the potential of this magnificent machine. And even on the ground, as already felt during the initial ground tests, the A380 handles as easily as any other aircraft. Also, the systems and the Rolls Royce engines performed satisfactorily."

Historic

Since the turn of the century numerous experts and businesses have been involved in the Airbus project. Naturally, fluid power companies have had their part to play along the road to the his-

toric maiden flight of the awe-inspiring 'super-jumbo'.

Bosch Rexroth, the drive and control company, in 2003 secured a major £1.4 million contract for the design, supply and installation of hydraulic services for three wing assembly jigs at the Airbus manufacturing facility at Broughton in North Wales. The giant jigs, each of which held a port and starboard wing of the A380 twin-deck aircraft, measure in the region of 60m long by 30m wide by 12m high and comprise five levels of high rise staging, providing worker access to the wing panel surfaces. Each unit incorporates 170 hydraulically-operated elevating platforms, known as 'flip floors', 24 panel loader stations, a series of lifts for manoeuvring automatic drilling machines and 34 high pressure remote tool stations for cold working metal and fastener installation on the wings.

Competition

The Industrial Hydraulic division of Bosch Rexroth UK was initially awarded a £27k contract in October 2001, for the design of the in-jig hydraulic services, which was won against competition from the design house and

hydraulics sectors. The contract involved all of Rexroth's design engineering resources and, after several reviews at Electroimpact's Seattle offices, was approved in March 2002. Rexroth then tendered for the installation stage, once more against stiff competition, and was selected by Airbus UK, following recommendations by Electroimpact. The £1.4m order covered hydraulic hardware, including centralised pump units and local control panels, extensive pipe-work installations and the flip floor hydraulic cylinders, which were designed in association with Bosch Rexroth Sweden.

Designed in collaboration with major airlines, airports and airworthiness authorities, the A380 has been described as the most advanced, spacious and efficient airliner ever conceived; the craft will seat 555 passengers in a three-class interior layout and have a range of 14,800km. Thanks to new generation engineering and advanced wing and landing gear design, it will be quieter than today's largest airliners, with a more efficient fuel burn. A number of innovations will ensure considerable weight savings, despite the aircraft's prodigious size, including the use of carbon fibre-reinforced plastics for the central wingbox and advanced aluminium alloys for the wing panels. In common with other

Airbus aircraft, the A380 is being manufactured at different sites across Europe, each responsible for producing a complete section, although due to their size the new airline parts will be delivered by surface transportation for structural assembly in Toulouse. Electroimpact is working in close collaboration with Airbus in the UK on the A380 wing manufacture and is the main contractor for two major projects. For Stage 0 wing panel assembly, it is supplying four 165m-long automated lines for building the upper and lower panels, while on Stage 1 it is building the three wing jigs, which accept the panels from Stage 0, together with the spars and ribs. On completion, the wings are removed by overhead crane, painted and fitted with electro-hydraulic systems and loaded onto a barge on the nearby River Dee, for shipping to Airbus in France.

Centralised


Rexroth has designed and installed the purpose-built hydraulic cylinders, valve control packs and zinc-plated pipework mains, which operate the 170 flip floors on each jig, in addition to the centralised pump units that serve this and other functions. These retractable floors are attached along the full length of each stage, allowing work on various parts of the wing; each has two pivot points and is pushed through 90° by Rexroth hydraulic cylinders, which retract when the floor is in the 'down' position and are extended for the 'up' mode that also serves as a safety barrier. The cylinders are regulated by a total of 288 single and double flip floor valve panels, each of which houses one or a pair of Rexroth 4WE6 double solenoid, directional control valves and counterbalance/speed control modules, mounted on a manifold block and connected to the hydraulic ring main.

Fluid power for each jig is provided by a centralised pumping sys-

tem, consisting of a hydraulic power unit and fluid reservoir assembly. This comprises four Rexroth variable displacement axial piston pumps and motors, with two A4VSO units serving the flip floors and panel loaders, delivering a total output of 110 litres/min at 210bar, and two EA10VSO pumps, with an output of 290 litres/min at 80 bar. Pressure switches detect when there is a 'no demand' situation and after 10 minutes full pump flow will unload to the reservoir at virtually zero pressure, while after a further 20 minutes the pumps will revert to 'shutdown' mode.

Elevators

The innovative A380 wing assembly jigs incorporate automated drilling machines, for skin-to-spar and skin-to-rib drilling, which are carried on goods elevators, known as HAWDE lifts, and parked at different work stations, with the flip floors retracted. Each jig is equipped with four 4-storey and four 2-storey HAWDE lifts and Rexroth is also responsible for the eight isolation and flow control manifold units, zinc-plated hydraulic tube and pipework, as well as the centralised pump units that drive them. There are also 24 panel loader stations which lift/lower the aluminium panels between levels and present them to the wing, and these will utilise the same flip floor hydraulic pump system.

This maiden voyage of the A380, during which all primary flight test objectives were met, marks the beginning of a rigorous test flight campaign involving five A380s and some 2,500 flight hours. It will culminate in the aircraft's certification followed by its entry into airline service in the second half of 2006 with first operator Singapore Airlines. The scope and rigour of the A380 ground and flight test programme should ensure that the craft makes a smooth entry into service next summer.  554