Vol. 5
May Issue
Year 2004

Publication for the Peening, Blasting and Vibratory Finishing Industries

ASIAN AEROSPACE

Metal Finishing News

MFN

Distributed in North & South America, Europe and Asia

4th Asian Shot Peening Workshop

8-10th Nov 2004

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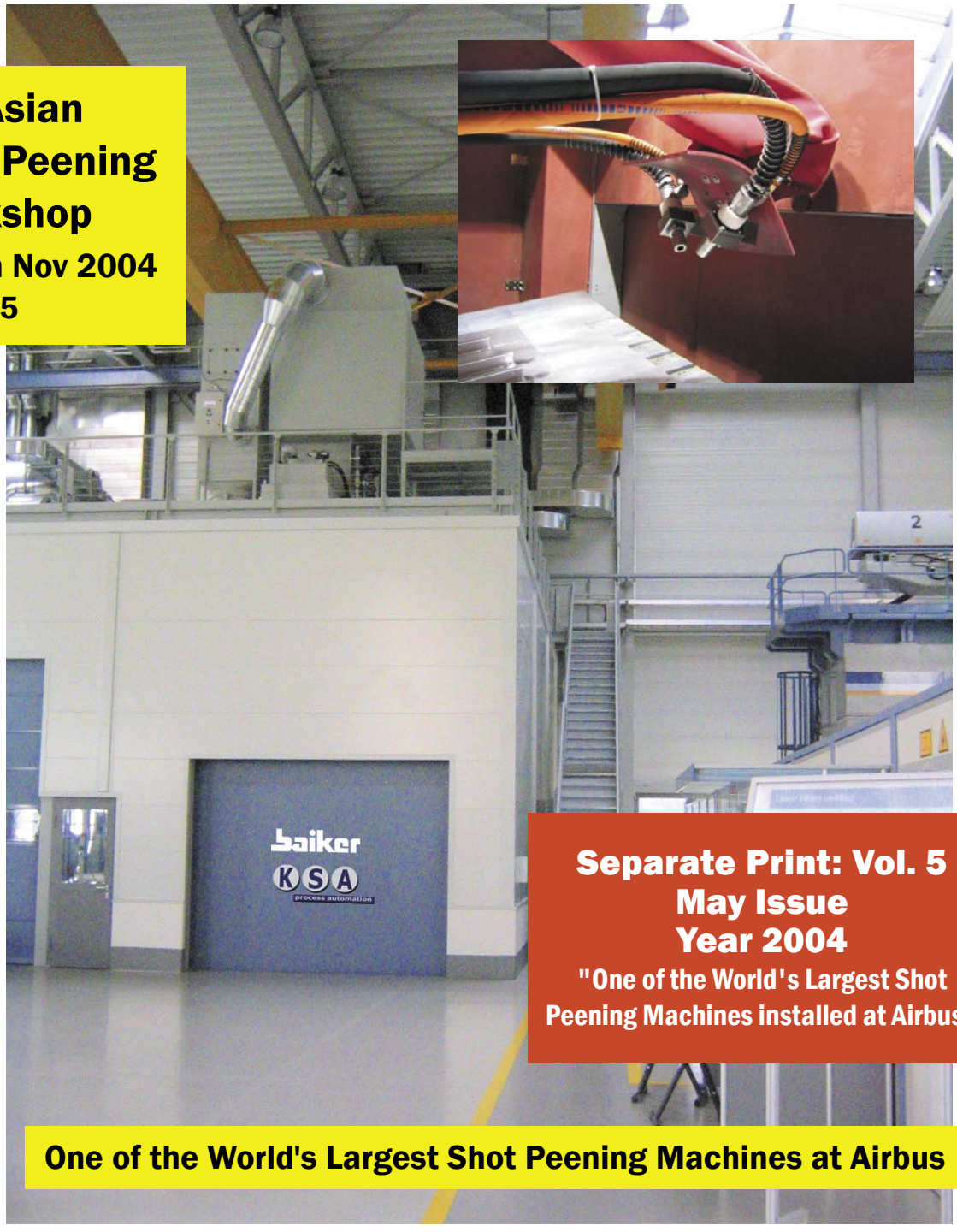

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"One of the World's Largest Shot Peening Machines installed at Airbus"

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One of the World's Largest Shot Peening Machines installed at Airbus

For many years, shot peen forming has been regarded as a rather outdated process in terms of process control and computability. Hand peening has been necessary in most applications at least for final correction steps and, as a result, the industry has not taken shot peen forming seriously into account when investing in new production programmes. The same was true of Airbus Germany until 2001, when the company needed final forming to be carried out on new fuselage shells. By a happy coincidence, a meeting of Airbus engineers with KSA Kugelstrahlzentrum Aachen GmbH occurred at around the same time.

Airbus Innovation for A 380: Laser-Beam Welding

A major challenge in aircraft design is saving weight and therefore reducing fuel consumption and airline operating costs. Airbus, an EADS joint company with BAE SYSTEMS, has developed a number of new technologies, i.e. new materials, new structural designs and new manufacturing processes in order to meet these challenges. These innovations and new technologies will be incorporated in the A 380 family, which is the Airbus flagship for the 21st century.

Integral structures for aircraft fuselage today consist of aluminium sheets and stringers, whereby innumerable rivets are needed as joints. However, Airbus has recently used laser-beam welded structures instead of rivets for A 318 and A 380 fuselage shells – a first in the aircraft industry.
One 'Airbus Center of Competence' for manufacturing fuselage shells is based in Nordenham in northern Germany, where the laser-beam welding process for fuselage shells has been developed and introduced. Two laser facilities have been installed to date and the third is under construction.
After the laser-beam welding process, forming the shells into the final contour is the last step in the production chain before painting and further assembling.

Customer Needs for an Automated Forming Process

Forming the fuselage shells into the final contour had to be flexible to design changes, applicable to a wide range of fuselage shells with a length of 4-11 m, reliable in a 3-shift operation and fully automated. Another need was full integration of the forming process into the production chain.
In other words: Airbus did not wish to have any manual processing, not even for corrections. And Airbus asked for a qualified established process as well as for a qualified partner to implement the new process at their site.

KSA's Implementation Programme

The first step of the implementation programme was a thorough analysis of customer requirements accompanied by tests in terms of technical and economic feasibility. For example, the through-put time had to be at least as fast as laser-beam welding, with the potential of being reduced to just half of the laser process time.
Because of the very tight schedule dictated by A 380 planning, Airbus opted for KSA's peen forming process, which is already established in several Ariane programmes, and for Baiker as the machine supplier. KSA, serving as a general contractor to Airbus, was and still is responsible for implementation of the whole process. Baiker, as a subcontractor to KSA, delivered the shot peening machine.

Pre-Run Production and Process Qualification

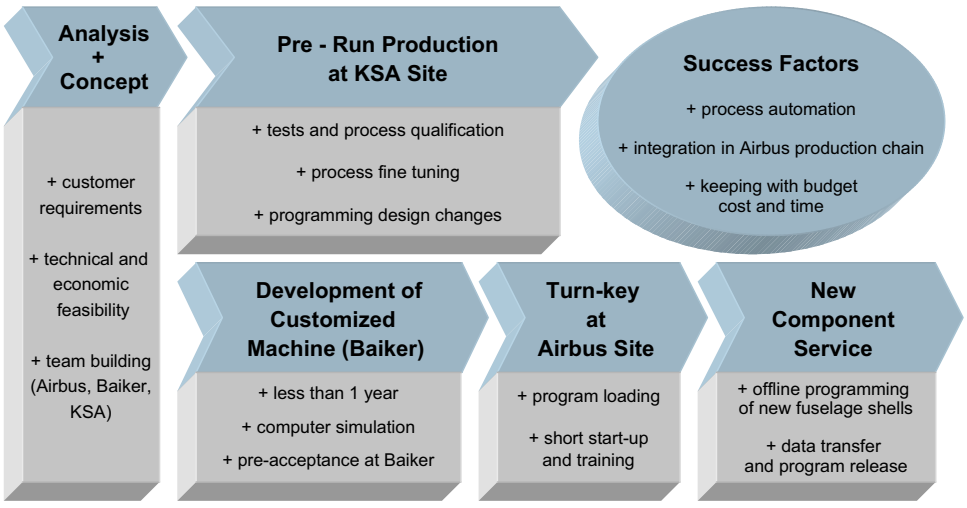
After finishing a joint testing programme successfully, KSA peen formed more than 100 qualification parts and serial shells on one of its two peen forming facilities in Aachen, Germany.
This pre-run production served two purposes: Firstly, to qualify the shot peen forming process in accordance with quality standards at Airbus. Secondly, to peen form the A 380 fuselage shells in Aachen as these had to be manufactured before installation of the serial production machine in Nordenham. As a result, it was possible to form the shells without delaying planning at Airbus for the introduction of the A 380. Besides, the general contractor was able to improve process performance and to adopt design changes without difficulty.

Machine Requirements

At the same time, Baiker developed, built and assembled the machine for pre-acceptance tests at the Baiker plant in Zurich, Switzerland. The overall dimensions of the machine are truly impressive: The peening cabin alone is 13.5 m long, 4.5 m wide and 6.0 m high.
The facility features an injector-gravitation peening system for shot of 4.00 mm in diameter. It is designed for forming components with maximum dimensions of 11,000 x 3,100 x 1,500 mm3 (length x breadth x height) and can be positioned to an accuracy of ± 0.1 mm for all six robot-axes. The same conditions are available on both additional axes for corresponding linear movement and for the transport wagon which charges the components.
The Swiss company met all the project deadlines and delivered the machine to the Airbus plant in Nordenham within 1 year. Key factors necessary to achieve these goals included computer simulation in conjunction with the German robot manufacturer Motoman, simultaneous engineering and regular project meetings with Airbus and KSA in order to exchange new information arising from pre-run production.

Turn-key at Airbus Site

Installation and acceptance tests of the machine took place in Nordenham in November 2003, fitting in perfectly with Airbus planning. The machine was then programmed by KSA for the automated peen forming of 8 different A 380 fuselage shells using online velocity measurement for machine calibra-



Implementing Automated Shot Peening at Airbus' Site

tion as well as a 3-D laser measurement system for the automated teaching of peening traces.

A short training session for Airbus operators followed. Because of the high degree of automation, no extra personnel is necessary for the shot peening machine; the programs are simply called up by the operators of the nearby laser-beam welding machine. In order to ensure high availability of the machine, Baiker and KSA have also defined a regular maintenance schedule.

New Component Service

Airbus planning for the introduction of laser-beam welded fuselage shells to other aircraft is certainly ambitious: Besides the A 380 programme, laser-beam welded panels will be used in the A 318 and A 340. And the Airbus single aisle family will follow.
All new technology and machinery must therefore be designed for high flexibility. KSA offers a 'new component service', which means carrying out programming offline and then transferring the program to the machine in Nordenham. In this way, a new fuselage shell for shot peening can be introduced within an extremely short time and with a minimum of disruption to serial 3-shift production at the plant.

Start of a New Era in Shot Peening

The Airbus example can be seen as a first benchmark for shot peen forming as a state-of-the-art industrial process, i.e. a fully automated process which is integrated in the aircraft manufacturing chain and requires very little operator time. Moreover, the peen forming process automation implemented at Airbus is completely transferable to all other shot peening applications. The times of 'trial and error' are over.

It is now time to regard shot peening in a new light: High-precision robot-aided machines and new process control technologies raise shot peening to the level of modern industrial processes. Standards such as 'complete process control and documentation' and 'computability' can now also be applied to shot peening.
In the future, the Airbus example might well encourage process engineers in the aerospace and automotive industries to take advantage of new shot peening solutions of this kind, resulting in higher quality and better cost efficiency for the customer.

IN THE SPOT LIGHT:

KSA specializes in shot peening process automation and offers one-stop shopping services and solutions for demanding customers. For Airbus, the German company is serving as a general contractor, implementing automated shot peening in the form of contract peening and system integration services.

Baiker AG in Zurich delivered the shot peening equipment. The Swiss company manufactures CNC and robotic dry & wet peening machines and works mainly for the aviation and automotive industries. It was founded in 1935.

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