

# Technology update

## Sizing up the A380's wings

Manufacturing the A380, now undergoing its flight test program, has seen **Airbus** and its suppliers having to tackle many difficult and complex challenges. Some of them have centered on the size of components, including the machining of 35-m long aluminum alloy billets for the aircraft's wing skin panels.

Airbus UK, with factories at Filton and Broughton, is responsible for the design and build of all Airbus wings. For the manufacture of the A380's wing, the company needed two new, high-speed milling machines for 18 of the 20 upper and lower wing skin panels of the aircraft. Handling such huge lengths of material is not easy, and the company found few machine tool companies capable of building equipment sufficiently large to carry out the task.

But Canadian company **Machine-Outils Henri Liné** was able to develop outsize skin milling machines to meet the needs of Airbus for the A380. "We believe machines of such advanced design to be the only ones installed anywhere in Europe," said Mike Brown, Managing Director of **M-TECH**, Henri Liné's UK agent. "Achieving the final specification involved highly detailed consultation with the A380 team at Airbus' Broughton facility regarding productivity, accuracy, process assessment, and longevity of the machines," which are gantry-type high-speed milling machines with twin heads for the concurrent machining of pairs of wing skin panels.

Brown explained that a major innovation is the application of "carpet milling." "The machine bed is at floor level, which provides ease of use and added safety," he said. "Each head comprises three axes of movement. Upgrade to five-axis milling is easily achieved to meet any future component design changes." The aircraft and its variants could be in production for at least 20 years, and refurbishment of the milling machines is not planned for 10 years.

One special feature of the machines is the location of its operator in a cabin



Checking a billet on the bed of the A380 wing skin milling machine at Airbus UK.

remote from the gantry. "Closed-circuit TV ensures that the operator has a clear view of the machining action, and the air-conditioned, soundproof cabin offers a level of comfort and safety not normally associated with such machines," said Brown.

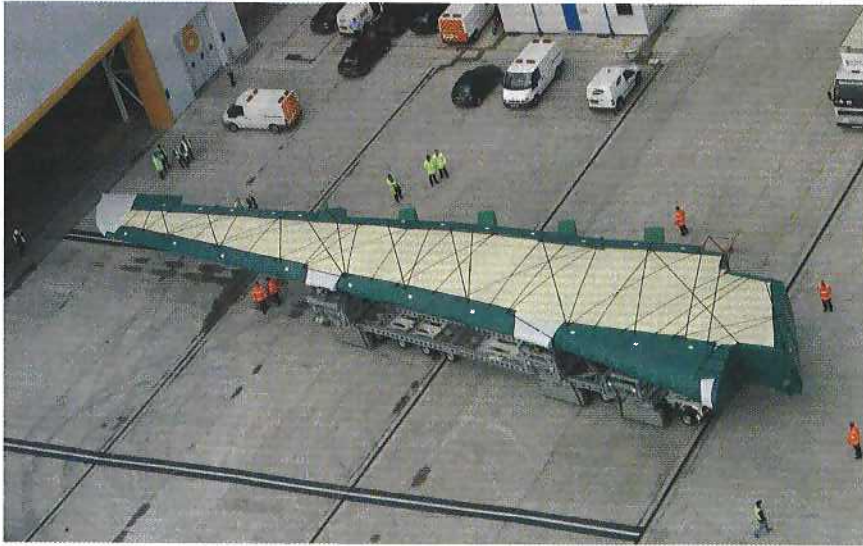
Starting with 25- to 35-mm thickness billets of aluminum alloy (2000-series for bottom skins and 7000-series for top skins), the machines takes some 100 h to mill a pair of skin panels, reducing about 85% of the material volume. When roughing out, a 75- x 5-mm router tool is used, turning at 12,000 rpm, with a feed rate of 7 m/min while using the full capability of the 85-kW spindle. Most skin panels have little machining on the outside face, but the inside face of the A380's panels incorporates machined features including stringer ramps, facets, and strip surfaces. The extreme outboard skin panels demand particular accuracy as they also have the ribs machined as integral features.

Production demands for the A380 already dictate that the two machines operate 24/7 on a two-shift pattern. However, to get to this stage took a three-year project to specify the machines; get approval for the design; and have them built, installed, and commissioned.

While the number of potential machine tool suppliers was limited by the special nature of the machines, so too was the number of suppliers of control gear. To help decide on the best package, the production engineers at Airbus created a comprehensive decision matrix. Each prospective supplier was scored against various factors, and then the weighted scores were compared. **Siemens' Sinumerik 840D NC** was chosen.

"The market for CNC equipment is developing rapidly, which makes it tough for companies such as Airbus to select suppliers. For example, the Sinumerik 840D now benefits from many facilities, features, and add-ons that were not available three years ago when Airbus first started the procurement process," said Dirk Rabeneck, Senior Aerospace Business Manager for Siemens Automation & Drives MC (Motion Control). It is essential that suppliers of CNC equipment can work in conjunction with the machine tool manufacturer, its agent, and the end user, to ensure that the optimum solution is provided to meet immediate and long-term needs."

The Sinumerik 840D incorporates a Siemens S7 PLC (programmable logic controller) and separate microprocessors



An Airbus A380 wing leaves Airbus UK's Broughton factory en route for Toulouse and final assembly.

for communications. Functions such as "look ahead" and "smoothing" help to enhance productivity and quality, especially when coupled with spindle power monitoring.

Airbus is employing the latest release of the CAM-POST Sinumerik

840D CNC post-processor from **ICAM Technologies**. The ADVANCED model is a five-axis mill post-processor, specifically designed for the aerospace industry, permitting tangential arc fitting, NURBS (non-uniform rational B-splines) fitting and interpolation, CIP (circular

interpolation) oblique circular interpolation, and standard canned cycles. It supports RTCP programming based on the 840D TRAORI (transformation orientation) function and local co-ordinates system programming. A key function is the support of the 840D customizable HSM (high-speed machining) feature, based on the Sinumerik CYCLE832.

Siemens offers its own WinBDE software for the acquisition of production data, but the flexibility of the 840D also enables other packages to be integrated. Airbus has opted to use its own Tacoma package that collects production data as well as monitoring spindle power for the dual roles of optimizing the machining efficiency and protecting the spindle from overload. Similarly, rather than use the Siemens SinTDL tool data information software, Airbus chose to use the Henri Liné tool data package.

Siemens also supplied Airbus with **Weiss** high-speed spindles (Weiss is part of the Siemens Group), Simodrive 611-D drives, servo motors for the axis control, panel-mounted and handheld HMIs (human-machine interfaces), and industrial PCs.

Stuart Birch

## Managing projects more effectively

Controlling the budget and timescale of large and complex aerospace projects is a highly demanding discipline. Now, **ACSIAN**, a UK university spin-out company has announced a new software package designed to provide greater control and effectiveness.

Formed by Jim Scanlan, Professor of Engineering Design, **University of Southampton**, and Ian Poccachard, Engineering Systems Developer, **Rolls-Royce** Defence Aerospace, ACSIAN has been established to help major companies achieve success for large-scale projects and to support delivery on time and to budget using its new software, Plexus Manager.

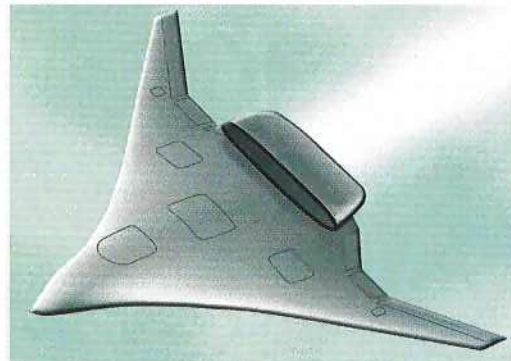
"As an illustration of the problem, of the UK's top 25 weapons programs, 23 have missed, or are forecast to miss, their in-service dates," said Scanlan. "In all, they are almost \$5 billion over budget. Plexus Manager is designed to be flexible, to allow for the inevitable changes that are made within active

projects. The project manager then has a much better feel for the likely impact of changes and problems encountered during the project and can make appropriate decisions to affect best use of time and resources."

ACSIAN has been established with funding of more than \$700,000 from early stage technology transfer specialists and intellectual property company **IP2IPO** and from the SULIS Fund, owned by the Universities of Southampton, **Bath**, and **Bristol**.

Scanlan and Poccachard, together with six other engineers and academics, have spent many years developing the software, described as the product of the team's extensive experience in working with large aerospace organizations.

"The founders of ACSIAN have a great deal of firsthand experience of what to do—and what not to do—when managing large, complicated engineering design projects," said Scanlan.



**Aerospace projects are highly complex to manage and are likely to become even more so with the increasing importance of environmental issues. ACSIAN may help the project manager's task.**

"We have built on this experience to produce a powerful and radically different new software tool that enables organizations to combat the principal causes of project failure."

Stuart Birch