Turkish Aerospace Industries (TAI)

VERICUT supports low volume, high variety aerospace production

Supplying components and services to both the civil and defence aerospace sectors, Turkish Aerospace Industries (TAI) has a global reputation for design and development, manufacturing and integration, aircraft modernisation and life cycle support. At Turkey’s most advanced industry supplier, many of these functions are supported by VERICUT CNC simulation, verification and optimisation software.

From its 275,000 m² facilities in Ankara, Turkish Aerospace Industries (TAI) provides national and international support to the global aerospace sector. Since the company was established in 1986, it has developed its skills and services in key strategic business units, including fixed and rotor wing aircraft, aerostructure components and systems, UAV, space and special programmes.

Within these strategic business units nearly 5,000 skilled and well trained staff are employed, and the company is accredited to the latest international and customer-specific quality standards. Significant investment in machine tool technology has resulted in a shopfloor equipped with the ‘best in class’ machine for each task, with 3-, 4- and 5-axis horizontal and vertical NC machining centres efficiently cutting the materials commonly found in the industry, including aluminium, titanium and high strength steel. High speed machining techniques are employed, with the latest HSM machine tools from DS Technologies, Huron and Chiron. A total of 200 people are machining components around-the-clock.

Supporting the machine shop with all of its manufacturing programs, the company runs both Catia and Siemens NX CAD/CAM software, and sometimes Esprit CAM as well. Each has the ability to do the work required by TAI, including 4- and 5-axis NC tool paths. “Ultimately, the customer will choose the CAD/CAM route, sometimes making the use of specific software mandatory. For example, for JSF we had to use Catia V5,” explains Onur Bahtiyar, Leader, NC Programming Department.

He leads a team of 20 highly skilled staff working in the NC Programming Department, creating manufacturing cutting tool paths for the various machine tools, and also supporting the tooling development engineers, that create the assembly fixtures and tooling required for sub system production.

Low volume, high variety production means the department is currently working on 150 projects for various customers and also for its own range of aircraft, which include the Hurkus pilot trainer and T129 ATAK helicopter. So the NC Programming Department has to initiate every possible efficiency gain, and this was part of the drive for the investment TAI made in CGTech’s NC simulation and verification software VERICUT. Floating software licenses mean each PC has the ability to run the simulation program.

NC Engineer, Mete Koyuncu, recalls: “Before investing in VERICUT software the NC programmer only knew the results of the toolpath during the actual ‘prove out’ trial run on the machine tool. This had to be done very carefully, with reduced speeds and feeds and it is very time consuming. It is a risky process and it can cause many problems, such as spindle or axes collisions on the machine/workholding and gouging of the raw material.”
“VERICUT simulation allows the prove-out process to be done in a virtual environment in the NC Programming Department. The G code NC program created by the CAM system is taken into VERICUT for verification. Although the first actual part run will be done carefully most of the errors will have been found using VERICUT and corrected by the NC programming team. We feel more confident now we use VERICUT. And, the machine operators also feel more comfortable running the part knowing it have successfully passed through VERICUT.”

In fact, NC programs are only released to the company's manufacturing network after being successfully machined in VERICUT. From here the operator can pull the 'safe NC program' down to the machine tool's controller.

Even with the knowledge that a FAIR (First Article Inspection Report) part has been verified with VERICUT it will still be produced at a reduced speed, but once the part is approved and serial production begins it is quickly ramped up to the intended speed to meet the required cycle time and not cause any production bottlenecks.

“VERICUT is the safest simulation program and the machine simulation model is very successful,” says Mete Koyuncu. With the exception of its fibre placement machine, TAI staff created all the simulation machine models for its various machines tools, as well as the machine set ups, to retain complete process control.

All fixturing and set up details are supplied by the NC programming department along with the comprehensive cutting tool lists required to make the component. Machining and VERICUT macros may also be included with the production data. Macro writing support is supplied by Cem Alpay, Technical Manager of CGTech's Turkish reseller, Ucgen Yazilim. He explains: “VERICUT has its own programming language, which is a little different from C++ or Visual Basic, and for some of the more advanced macros we can provide the support required by TAI.”

TAI use the very latest version of the software, and Onur Bahtiyar adds: “Like all software packages, VERICUT has become more capable and complex with each version, so help and support is sometimes required. You have to become familiar with new interfaces and get use to the functions which takes time, and we don’t have time because we are extremely busy – everything on the TAI shopfloor is urgent. So, again, the support provided by Ucgen Yazilim becomes vital. We work with Cem Alpay to solve any technical issues and he also provided all the training for our staff.”

VERICUT modules at TAI include 3-, 4- and 5-axis machine tool simulation, Auto Diff, and also two seats of CGTech’s OptiPath optimisation software. This software is applied to most new machine tools to reduce the air cutting times, and if OptiPath is applied to adjust the chip load it reduced the tool breakage and increases the life of the cutting tool so it provides a benefit to production.

"Usually the customer will supply an MBD (Model Based Design) toleranced solid model which we also check against the drawing to ensure we have the correct information to work from,” states Onur Bahtiyar. “The solid model is taken into the CAD/CAM system and the programmer will decide which machine tool will be used on the shopfloor. Machining strategies, cutting tool paths and fixtures are applied and the post processor for the machine tool selected is used to generate the manufacturing NC code.”

He continues: "For complex components, such as those on the JSF, part probing may be required on the machine. We might machine the surface and then drill holes, probe the holes and surface between machining operations for critical features on both metallic and composite components.”
TAI also supports MRO (maintenance, repair and overhaul) operations and the first challenge is often finding the technical documents, from these the company can create a solid model to work from. Sometimes it has to reverse engineer the component, but whichever method is used it will always use VERICUT to prove the part.

For the composite components on the JSF programme TAI has invested in a MAG Viper 1200 AFP machine. "We use VERICUT for Automated Fibre Placement (AFP) machine simulation. The software is also used by the customer so the transition of part was very straightforward. Going forward we will consider using VERICUT VCP as we want to invest in other types of fibre placement machines, each may have a specific programming and simulation software package but we will use VERICUT as a common programming platform, we know that by using VERICUT VCP we can program every machine type," Onur Bahtiyar states.

At TAI, cutting tool and machine tool technology is always tested to find the best results. "Sometimes the customer will specify the machine tool type and we use VERICUT to confirm that the machine is capable of producing the part," Onur Bahtiyar concludes.