Case Study

Bridging Troubled Waters The High-Tech Way

By Tim Earl

A leading UK defence company, Alvis Vickers Ltd (AVL), uses Leica Geosystems' cutting-edge laser tracker technology to ensure the required pinpoint accuracy for assembly of its military pontoon bridges.

AVL, the sole armoured vehicle supplier to the UK armed forces and a major player on international defence equipment markets, has recently purchased Leica's state-of the-art LTD800 laser tracker system to guarantee precision machining and assembly for both major components of its world-renowned BR90 military bridging system. AVL also acquired a number of accessories, including an I-Paq radio remote control.

AVL chose the Leica system, which was delivered and commissioned in early 2004 to AVL's Wolverhampton site, in the face of stiff international competition. It cites the Swiss-based company's combination of proven professional excellence, industry-standard status, top-level support and general reputation as key purchase criteria.

Alvis Vickers Ltd (AVL)

Leica Geosystems

Military pontoons – more than just a house of cards…

Machinist Ron Callaghan, who uses the LTD800 to continuously re-orient machine tools towards the bridge pontoons, says: “I don't know how we would have done this without the Leica Laser Tracker.”

Phil Owen, who operates the Leica system on-site for AVL, adds: “The I-Paq remote control is really useful, especially when you are on the other side of the object where there is no line of sight; it makes it a true one-man system.”

Pontoon bridges consist of two main types of assembly: the large individual floating pontoons that form the base of the construction, and the variable-length bridging sections that are mounted on the pontoons.

The pontoons are large aluminium fabrications measuring 9m by 3m by 2m. Interfaces on each pontoon allow them to be joined together as necessary to provide the required level of buoyancy according to the extent of the load placed on each bridge section.

Armies live on their stomachs – and on precision engineering…

It is therefore essential that the interfaces are machined with high levels of accuracy and consistency – otherwise engineers in the midst of a major military exercise might find themselves unable to join the pontoons together as required.

To ensure compliance with these machining standards, there is a specific construction requirement for the interchangeability of pontoon interfaces. In practice, the pontoons can be manoeuvred and steered in the water like small boats, and each has its own motor.

The bridging sections combined to form the platform of the bridge that vehicles will cross also have high-precision interchangeability requirements to enable them to be joined together quickly and accurately.

Alvis Vehicles – which merged with Vickers Defence Systems to form AVL – is no stranger to Leica's market-leading tracking technology. Alvis has been a Leica account for 15 years, when it first purchased an automated – and recently decommissioned – theodolite measuring system called SPACE to measure bridge panels.

Mixing and matching in three axes…

AVL's main reason for purchasing the LTD800 this year was to acquire the capability to measure the pontoon interfaces in a pre-machined state (plus metal) with respect to datums on the pontoon.

In this way, a precise interface machining plan can be established, telling the machinist exactly how much material needs to be removed from each individual interface to ensure the dimensional integrity of the interface requirements is met.

Leica even tailored an easy-to-understand electronic report for Alvis, to help apply shifts in all three axes to calculate the ideal machining plan. AVL technicians say their confidence in the laser tracker measurement process grew steadily each time the predicted datum turned out to be an exact match to the final machined datum.

During the demonstration phase for the measurement process, another measurement operation was added, without which the machining of the interfaces would not have been possible.

Don't lose track of that datum…

Because of the large size of the pontoons, it was not possible to machine interfaces on either side of the pontoon without moving it in the machine tool – thus causing datums to be lost.

To resolve this problem, Leica suggested temporarily welding on some spigots on either side of the pontoon, which could be used as secondary datums. Doing this enabled the machine tool to orient itself with respect to the pontoon regardless of how many times it was moved in the machine tool.

The laser tracker is also used to measure interfaces on the bridging sections.
AVL staff had five full days of formal training with the new equipment. In this case, the training was broken down into two sessions, comprising an initial three days training followed by a further two days a fortnight later, both on-site at their own premises. After formal training ends, Leica continues to provide ongoing informal training during routine visits, to ensure the system is properly implemented.

Manufacturing engineering manager Shane Hill and chief test engineer George Dowling say that Leica's training and support for the LTD800 installation and use was “excellent”, and add that top-level support has been a characteristic of Leica's offer throughout their 15-year relationship.

The LTD800

Basic principle: The system combines horizontal and vertical angle measurements with distance measurements to determine the three-dimensional co-ordinates of a reflector within any tool or part co-ordinate system. Motors support fully automated measurements and a position detector guarantees high-speed tracking capabilities.
Leica's key technology: The angles are measured with high precision encoders, and actual distances are derived using a patented Leica technology for absolute or interferometric measuring devices. These allow two beams of light derived from a single source – and thus of the same frequency and in phase at identical distances from the source – to traverse paths of different lengths.
Tracking the difference: The different lengths determine the nature of the interference pattern obtained when the beams are allowed to interfere. The wavelength of light can be measured if the path length difference is known, and vice versa. The LTD800 incorporates this technology for precise and fast tracking and scanning jobs.

Where else is it used?

The Leica Laser Tracker series is used in a wide range of industries, ranging from aerospace and automobiles to robotics and railways.
A random selection of aerospace companies that use the system includes Aerospatiale, Boeing, British Aerospace, Daewoo Heavy Industries, DaimlerChrysler Aerospace, Airbus, Dassault, Fokker, Lockheed Martin and NASA – the full list is considerably longer.
In the automobile industry, users include BMW, Ford, GM, Peugeot, PICO, Scandia, Volkswagen and Volvo, while selected users in other industries include ABB Robotics Products, Accelerator Laboratory, Deutsche Bahn (the German railway operator), NIST, CERN, the European Commission's Joint Research Centre (JRC), KEK, Sulzer and Vertex.

About Alvis Vickers Ltd

The UK operations of Vickers Defence Systems were merged in 2002 with those of Alvis's existing UK armoured vehicle company, Alvis Vehicles Limited, in a combined UK business called Alvis Vickers Limited (AVL). AVL has facilities in Telford, Newcastle upon Tyne, Leeds and Wolverhampton. The combined complementary technical expertise of Vickers Defence Systems with Alvis Vehicles' background in light and medium armoured vehicles enables the combined company to offer a comprehensive capability to its worldwide customer base. AVL products include Warrior, Challenger 2 and 2E, the long-established Scorpion and Stormer, the Piranha family (built under licence from MOWAG), Tactica internal security vehicles, Supacat all-terrain mobile platforms, and armoured engineering support vehicles including the BR90 bridging system.

Leica Geosystems

Leica Geosystems

Leica Geosystems is an internationally leading developer, manufacturer and distributor of solutions that capture, visualize and process 3-dimensional data using the most advanced technologies in the marketplace. Leica Geosystems holds the foremost position in the world market in several high technology sectors. The company has representatives in over 100 countries worldwide. The firm's corporate headquarters are located in Switzerland. Leica Geosystems registered shares (LGSN-SWX) are quoted on the SWX Swiss Exchange in Zurich.

Metrology Division

The Metrology Division of Leica Geosystems is a global supplier of comprehensive hardware and software packages to the industrial metrology market. These products integrate with popular CAD programs, various build-and-inspect tools, and reverse engineering software. Using state-of-the-art laser technology, Leica's industrial measurement products make quality control, part mating, assembly and construction of large and small parts easier and more accurate than ever. Leica's laser tracker technology is most widely used, with over 1400 installations worldwide. In addition there are about 1500 Industrial Theodolite Systems the most accurate in their category.

For an updated reference list and additional addresses, please refer to our web site www.leica-geosystems.com/metrology

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