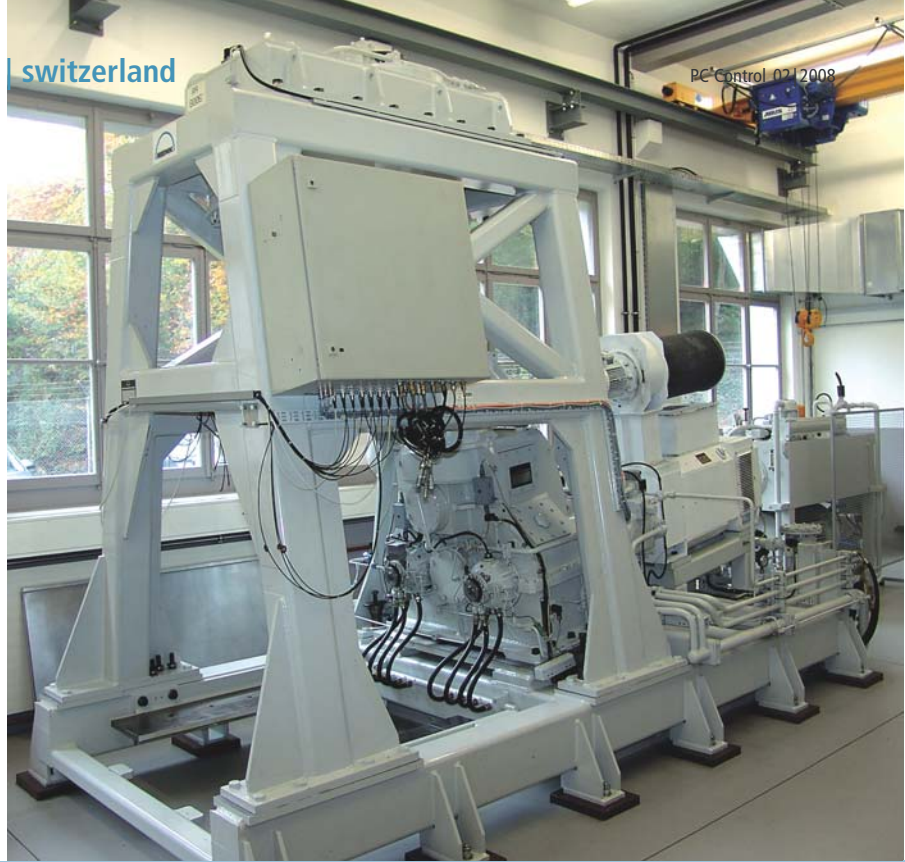


RUAG's MGB gearbox test rig: the cables are connected to the measurement points on the gearbox.

RUAG test rigs for
'Super Puma' transport helicopter

Engine testing in a helicopter hangar



RUAG Aerospace, based in Stans, Switzerland, is a pan-European operative aerospace company that, among other things, takes care of the maintenance, repair and overhaul of helicopter engines for the Swiss Air Force. BSR Automation AG, which was responsible for the electrical engineering, selected a Beckhoff control platform comprising a CX Embedded PC plus I/O components for a relaunch of the gearbox test rigs.



Test rig for testing the tail rotor gearbox



Rotor gearbox of the Puma



Tail rotor gearbox of the Puma

The Swiss Army helicopters in question are so-called medium transport helicopters of the type, AS-332 Super Puma, which are checked for airworthiness and functional capability at regular intervals. Among other items, this involves removing the gearboxes and testing them on the RUAG test rigs. "Naturally, our test rigs are certified. They are inspected by the manufacturer at intervals of two years and, in particular, compliance with limit values is thereby checked," explains Werner Vogler, Software Engineer from the RUAG Test Facilities Department.

"The test criteria with which gearboxes are tested include the speed of the rotor, the torque, the oil pressure of the gearbox, the temperature of the lubricants and the oil temperature. In addition, these variables are measured for compliance with limit values as the gearbox is under load," says Vogler.

Testing takes place in simulation mode

Neither the main rotor drive of the helicopter nor its tail rotor drive are placed completely on the test rig. In fact the respective gearbox is tested without a pro-

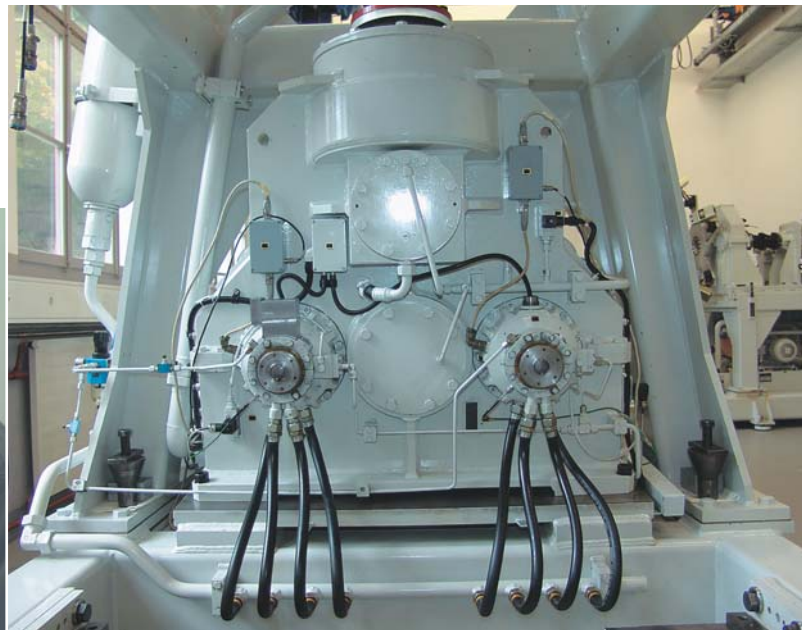
peller, but with an infinitely variable 377 KW direct current drive instead. In this manner, the driving power of the two helicopter turbines – two Turboméca Makila turboshaft engines – are simulated electrically. If one or more of the measured values for speed, torque, pressure or temperature exceed the tolerance limits during the approximately one hour long test, it must be assumed that there is some damage. For example, a part in the gearbox can rotate simultaneously and cause a mechanical fault.

The speed measurement using strain gauges and telemetry represents particularly high performance from the point of view of measurement. The turbine speeds ranging from 12,000 to over 20,000 rpm result in a rotor speed of 340 rpm. The radio measurement section must therefore offer very high performance. "The classic measured values for the other mechanical variables are generated by appropriate sensors and acquired as analog values. These analog values, which are in the form of voltage values from 0 to 10 V or -10 to +10 V as well as current values from 4 to 20 mA, are recorded electrically via Beckhoff Bus Terminals,

View of the coupling of the two hydraulic motor drives as a coupling of the turbine spindle on the MGB test rig



André Duss (right), from BSR Automation AG, and Robert Urech, from the Swiss branch of Beckhoff Automation AG, in front of the control cabinet of the MGB test rig



View of the coupling of electric motor drive and main rotor gearbox on the MGB test rig



Control cabinet of the gearbox test rig for the tail rotor with the CX1000 Embedded PC

processed in the CX1000 Embedded PC and then transmitted to the central test computer channel-by-channel," explains Vogler. The measured values are graphically displayed and documented in the test computer. "Naturally, we can also specify the limit values graphically," says Vogler, and he adds: "The progress of the test is also monitored digitally-graphically; this means we are able to terminate borderline or hazardous situations from the test rig using an emergency stop function."

Test rig with integrated acquisition of measured data

The first Puma MGB test rig for the main rotor gearbox was put into operation as early as 1995. The electronic components installed at that time had aged in the meantime and were no longer available in part; the visualization and the test rig controller were based on MS-DOS. That is why RUAG Aerospace decided to install new test rig equipment, including measured data acquisition, and commissioned BSR Automation AG from Kriens in Switzerland to carry out the work. The soft-

ware for the visualization and recording was newly created by RUAG in collaboration with BSR. BSR replaced the existing controller with a PC-based automation platform from Beckhoff: in order to acquire the measured data from the test rig, a Bus Terminal system with a BK2000 Bus Coupler was installed and networked with the remotely installed CX1000 Embedded PC via Lightbus.

"All measured data is acquired locally via analog terminals and the Bus Coupler, evaluated in the machine control and relayed via Ethernet to the test computer, on which the visualization runs," reports André Duss, Project Manager from BSR Automation, and he concludes: "The use of Beckhoff automation technology was not new territory for us, because we had already converted RUAG's smaller Puma test rig to Beckhoff equipment for checking the tail rotor gearbox."

→ Beckhoff Switzerland www.beckhoff.ch

→ RUAG Aerospace www.ruag.com

→ BSR Automation AG www.bsr-automation.ch