GTRI engineers are redesigning components of the air traffic control radios used to communicate between military aircraft and ground control stations. The goal is the keep the older radios operational until newer systems come online.

Radio Renewal:

Module Redesign Helps Military Air Traffic System Stay in Control

By Rick Robinson

Photo: Gary Meek

Christian Michelson, left, a GTRI student assistant, and GTRI researchers Steve Thompson, center, and Russell McCrory examine radio modules.

The air traffic control radios that help guide U.S. military aircraft tend to be a venerable breed – thousands are based on a design that went into service in 1968. Engineers at the Georgia Tech Research Institute (GTRI) are helping keep these workhorses on the job until newer designs replace them.

That task can be a challenge, says Russell S. McCrory, a GTRI senior research engineer. Some 7,500 of these veteran ground communications radios – known as AN/GRT-21 and AN/GRT-22 transmitters and AN/GRR-23 and AN/GRR-24 receivers – are still in service. And when they break down, they often require parts that are no longer available.

"This system has been in the field almost 40 years now," says McCrory, who is project director. "Many parts now unavailable were originally manufactured by hand, and would be very expensive to reproduce today just because of the manual labor involved."

Even more challenging are semiconductor components such as transistors and diodes that are no longer manufactured. In some cases the original makers are no longer in business; in other cases the products are so old there are no replacements for them.

Eventually, all U.S. Department of Defense radios are due to be replaced by a reprogrammable software-based technology known as the Joint Tactical Radio System (JTRS), McCrory explains.

Though the first JTRS systems could begin replacing high-priority radios as early as 2011, ground radios like the GRT/GRR systems are scheduled for replacement much later – probably not until 2020-2025. That means GRT/GRR radios could require maintenance for another 18 years.

In 1999, engineering responsibility for these radios was moved to the Warner Robins Air Logistics Center at Robins Air Force Base in Georgia. In 2005, engineers from GTRI were called in to produce documentation for the radios, and to create a support roadmap that laid out how to sustain the radios until they are retired. This analysis showed that major components of the radios would need to be replaced to meet this goal.

Currently, the GTRI team has a contract to redesign five major assemblies within the GRT/GRR, which is a complex system comprised of receivers and transmitters for both the VHF and UHF radio bands. The team has received $750,000 to redesign the system's dual-band-power amplifier unit, which has the unusual capability to broadcast a 10-watt radio signal in either the VHF or UHF bands.

Instead of trying to reproduce the original technology, GTRI engineers are designing replacement units that use only modern off-the-shelf parts. The aim is to give the customer a replacement module that is plug-compatible with the original unit and does the same job.

"We throw away the original design, and we make a unit with the same size and the same function," McCrory says. "If the old unit had a certain meter reading to show a certain condition, the new one should work identically."

In replacing the radio's original analog components, GTRI engineers are crafting a system that is still all-analog but uses new technology that is widely available. This approach allows the Air Force to ask for competitive bids from numerous manufacturers rather than relying on a sole source.

The savings can be substantial, McCrory notes. He cites a competing approach that would have cost the government about $500,000 for drawings of one obsolete transistor in the GRT system, and then at least another $500,000 for the first transistor reproduced from those drawings.

"Our approach will result in major savings for the military versus trying to remanufacture the original components," he says.

In many cases, McCrory says, his team's redesigns may allow radios to not only keep working but also to operate more effectively. For example, a redesigned synthesizer unit could dramatically reduce the complexity of tuning the GRT/GRR radios, which currently can be re-tuned only through laborious settings changes.

In addition, the new dual-band-power amplifier is expected to replace three older models, easing parts inventory tasks.

One of GTRI's top goals is to make it cheaper for the Air Force to simply plug in a new module than to repair an old one. The difference could save not only money and time, but also bring broken units back online faster.

"The Air Force, in conjunction with Tobyhanna Army Depot which does the maintenance, has done just a wonderful job keeping the system in the field," McCrory adds. "We're trying to help them continue to do that, while keeping costs under control and even improving the technology." rh

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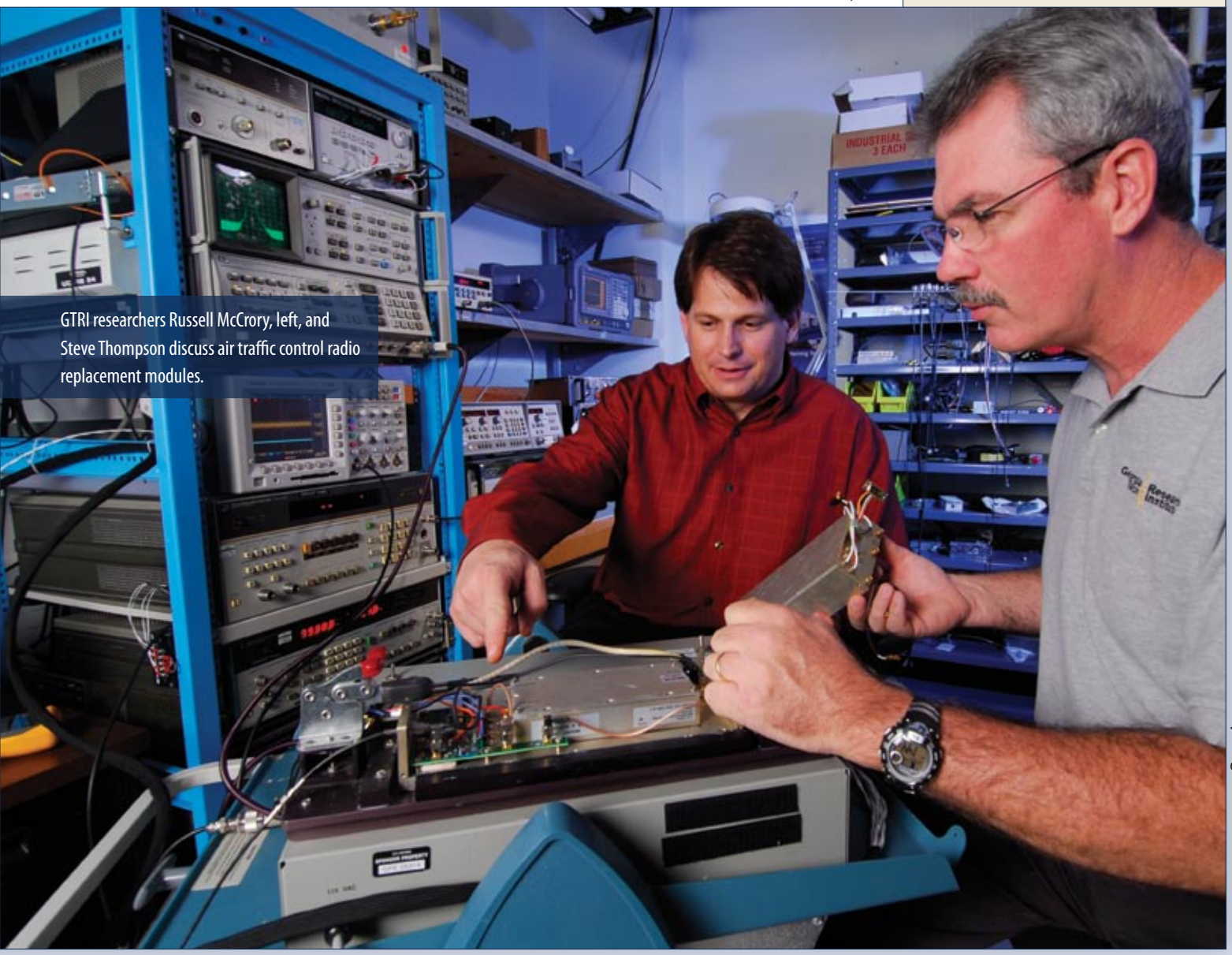

GTRI researchers Russell McCrory, left, and Steve Thompson discuss air traffic control radio replacement modules.