



BY PAUL RAKO, TECHNICAL EDITOR

## Overengineering: How much is too much?

**V**eterans Day 2007 brought to mind a story my father once told me. He was in the US Army's 8th Engineering Corps Division. His unit saw fierce fighting in Hürtgen Forest during World War II. He told me that Germany's battlefield telephone lines used sheathed-wire pairs in clamshell enclosures. A small lever energized a machined, cam-operated mechanism that smoothly slid the connector halves into engagement. Allied soldiers had standing orders to shoot through the engineered connectors and to cut the cable with their bayonets.

In contrast, the engineers who had strung the wire for the US field telephones left a few feet of loop every hundred yards, so that slack would be available to fix even large breaks. The current loop closed through the earth; only one olive-drab, insulated-iron wire connected to the phones. The Army used iron because it was more resistive and stronger than copper; that strength was necessary to withstand the hardship of soldiers' pulling it off the spools to the front lines of battle. Allied soldiers who encountered cut US-telephone wires had or-

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ders to use their bayonets to remove the insulation and tie the broken wires into knots, tugging hard to make good connections. They then threw the wire back into the ditch or bomb crater.

The results of these two engineering approaches became evident in the toughest fighting in Europe. If everything went according to the Germans' plan, their telephones worked far better than US phones. As soon as the Germans had to retreat or give up ground, however, the US soldiers made sure that the German phones would not work for weeks or months. The Germans didn't have enough clamshell connectors in warehouses to replace all those that US soldiers had destroyed with their weapons. The exact opposite scenario happened with US field telephones. When the US military gave up ground, the Germans cut the wires, but, as soon as any Allied troops retook the ground, they tied those knots and once again had working phones.

Certainly, the specs for the German phones were far superior. The signal-to-noise ratio and fidelity were fabulous. But those great specs were of little use when the phones didn't work. The US phones worked well enough in real-world battlefield conditions. The German phones were overengineered, which brings me to my point on overengineering: Good design is about making compromises on a continuum of choices. That fact describes analog design, and analog design is what life is all about. I don't really need 700 menu selections on a BMW iDrive joystick. **EDN**

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