New 'HART' for an Old Standard

Has HART 7 given this old standby a new lease on life?

by John Rezabek

The HART Communications protocol has been around for more then 20 years, and is perhaps the only one from its generation whose installed base continues to grow. With more than 20 million intelligent devices installed, you might wonder whether a new and expanded specification amounts to "fixing what ain't broke." Ed Ladd, of the HART Communication Foundation (HCF, www.hartcomm.org), says, "Our most recent report shows more than 70% of all process instruments shipped are HART-enabled."

By short-circuiting the bogged-down ISA SP-100 path to a wireless standard, HART 7 allows suppliers and end users to begin manufacturing, selling and implementing wireless networks in a way that wasn't previously possible. Along the way, the architects of the new standard seized the opportunity to plug some holes that increasingly were seen as fatal flaws relative to more modern standards like Foundation fieldbus (FF). With some major EPC firms in both hemispheres saying that up to 70% or more of projects adopting FF for large expansions, additions and greenfield sites, and with the successful demonstration of FF for SIL-rated process safety interlock applications, concern that HART was in danger of losing its dominant market position is not unreasonable. Will HART 7's new enhancements bring it up to par in the eyes of the decision makers who wish to exploit state-of-the-art digital integration of field devices?

Like other fieldbus protocols, HART was poorly supported, if at all, in the large legacy DCS and PLC systems of the 1980s and 90s. But many plants are still running on this legacy installed base, and many of those may remain that way for years to come.

Safety-instrumented systems (SIS) can account for two-thirds of the I/O in some processes or production sites, and even today, few SIL-rated logic solvers support either native HART or any other fieldbus I/O. Users who try to exploit wireless or HART 7 diagnostics for safety applications may find themselves straying a bit far from the herd. A plant near me, for example, is implementing WirelessHART to provide secondary level indications on storage tanks. Its tanks contain substances much less benign than milk, and whether a wireless installation provides any independent protection layer is worthy of some debate. Will HART 7 features rescue users who might be poised to "jump too soon?"

Since today's wireless transmitters typically "go to sleep" for anywhere from 60 sec to 1 hour or more (primarily to optimize battery life—they are capable of sub-second measurement and transmission), they "wake up" to make a measurement and transmit it in a fundamentally asynchronous fashion. Consequently, the old HART model of master-slave polling had to be adjusted to one that accommodated considerably more field device autonomy. This same property will be part of new "wired" HART 7 devices, so they now can independently send time-critical, time-stamped alerts to a host that has the smarts to "hear" them. One will not have to wait on host or asset management system based "polling"

to detect a condition that needs more urgent attention—the transmitter sends the message along with a time stamp immediately when the condition is detected.

Present-day HART 5 and later devices have a status bit that's set when the device has an issue, and if the host is set up to read it, it can subsequently poll for more detailed information about the problem. How well this all happens, how fast it happens, or whether it happens at all, is worth some investigation on the part of end users who are aiming to exploit these features. If you've implemented any OPC, you have doubtless noticed that compliance to the standard is very much a matter of interpretation and has been the source of many headaches for end users. HART has always provided test tools for manufacturers to validate their devices conformance to the standard, but the degree to which a feature is implemented or exploited can vary widely, especially on the host end.

Eric Schnipke, process control specialist at the INEOS Acrylonitrile (www.ineosnitriles.com) facility in Lima, Ohio, remarks, "We recently installed a new HART-capable control system with the hope of bringing in engineering units and secondary variables of all HART devices, but quickly realized that the older HART revisions were not supported by the system."

It's estimated that fewer than 20% of end users with existing HART-smart devices are using HART for more than initial configuration and re-ranging. If the end-user community consists of few pioneers blazing the trail, we are at the mercy of the supplier community to do the right thing, and advanced users are on the wrong end of the Pareto charts.

"We have to do what the market demands" says an engineer at a major DCS supplier. "HART, Foundation fieldbus, Profibus—we support them all, and the specs keep changing. With finite resources, we continuously prioritize our investments in those areas where we anticipate the greatest value will be delivered to the clients."

Schnipke hit a few speed bumps during hot cutover: "Once you have the system, there's no guarantee you'll be able to make use of all of your HART devices or that all devices from the same vendor will behave consistently. Two different versions of valve positioners from the same vendor did not have the same engineering units. This was the source of much confusion when configuring the XD_Scale (transducer scale) of the associated analog output blocks."

Users attempting to use some of the advanced features have been experiencing more frustration. For example, one end user is aiming to use the HART range-change bit to flag when a technician makes a range change using a field communicator that doesn't match the host. "You'll find that the function isn't clearly specified. Each vendor has implemented the function differently—or ignored it. There is no definition of what a host should do with the bit or how a device should implement the functionality, and there is no ITK (interoperability test kit) to test functions such as this."

How quickly HART data is accessed hinges greatly on the host implementation as well. Some hosts, like those from Invensys Process Systems (www.ips.invensys.com), devote one HART modem to each and every I/O point.

"We see very little difference in the speed with which diagnostic data comes up between HART and FF—it's essentially the same," says Charlie Piper, senior development program manager at IPS in Foxborough. If your host shares a HART modem across eight inputs or outputs, the performance can diminish greatly, and using HART multiplexors that poll 16 to 24 devices each is proportionately more sluggish.

Some suppliers have improvements in the making, such as the "Charm" I/O solution to be offered by Emerson. Clearly suppliers are sensitive to the fact that sluggish updates of HART diagnostics are not meeting the needs of end users.

The I/O from IPS is capable of polling individual HART devices at sub-second rates. Piper adds, "This unlocks HART secondary variables for use directly in process control schemes and allows reliable real-time and historic trending of interesting variables like 'actual valve position,' as seen by the positioners."

Pat Schweitzer, co-chair of the ISA100 committee on industrial wireless automation, sees the use of this sort of value-added information as key to getting HART and WirelessHART out of the "configure and re-range" rut where many users leave it. While native I/O card support for HART 7 is still under development at most system suppliers, the promise for improvements in update times is encouraging and should facilitate better utilization of its new capabilities.

One of the new capabilities of HART 7 is support for autonomous alerts, akin to the "device alerts" as implemented for Foundation fieldbus by Emerson's DeltaV. Fieldbus Foundation and Profibus specs now incorporate NAMUR NE-107 guidelines for diagnostic messages, and this fieldbus capability is being extended to HART as well.

"DeltaV with AMS has supported user-configurable prioritization and classification of PlantWeb alerts in a manner that closely paralleled the NAMUR standard, since the introduction of the Fieldvue DVC 6000 positioner and similar fieldbus devices," says Duncan Schleiss, vice president of marketing for DeltaV. "When implemented in coming revisions, both HART and fieldbus alerts will allow routing and prioritization per the NE-107 standard."

This sort of serendipity is no coincidence, but a direct outgrowth of the EDDL (Enhanced Electronic Device Descriptor Language) cooperation project between HART, Foundation fieldbus and Profibus. Fieldbus Foundation will be testing (fieldbus) devices and hosts for conformance to the standard, already released as an option in the latest ITK for field devices. Presently such testing for HART features is in beta mode, but it's reasonable to think other host suppliers will take advantage

of the synergies created by the EDDL cooperation project and create parallel accommodations for new HART 7 instruments. HCF's Ladd says, "A team of HCF member companies has been working on EDD-enabled host testing requirements for over a year. We expect to have EDD-enabled hosts registered in 2009."

Sorting and prioritization of the tidal wave of new diagnostic messages generated by new digitally integrated field devices is a key enabler for end users, who otherwise would be dealing with an ugly and potentially incomprehensible "alarm flood" of device alerts.

WirelessHART is a huge development, but similarities to the multi-headed hydra that was spawned by the "fieldbus wars" of the 1990's can't be dismissed. WirelessHART is a bona-fide open and less-than-proprietary standard, but not all the supplier-sailors are happily boarding the HART boat just yet. Still, many users appear willing to bet that technologies competing with WirelessHART will eventually become the Betamax of wireless protocols, leaving their choice as the de facto standard.

Chevron foresees a huge uptick in the use of WirelessHART after it managed to satisfy the IT police that it could be done without risk to the IT and PCS network. "The new wireless system is reliable and has passed our rigorous IT security review," said Mohammad Heidari, Chevron's automation engineer. At an onshore production site, Chevron deployed almost 700 units this year, all in a monitor mode.

Across the Atlantic, Paul Oram, senior controls consultant for BP's Exploration and Production says, "Fieldbus has made very little impact on our brownfield plants. HART and particularly wireless HART can be more easily retrofitted."

In contrast, Dr. Abdelghani Daraiseh, engineering specialist at Saudi Aramco expects his company will wait on the ISA standard. "Our direction is to use SP100 as a single wireless system for various plant applications, including Foundation fieldbus. There are significant cost implications, simplicity and reliability in using SP100 and subsequent standards and product releases. The use of WirelessHART within our plants is limited to addressing immediate business needs not addressed by SP100 due to the standardization and product offering delays."

At this point there's great potential for the 900 MHz and 2.4 GHz bands—already being consumed by non-process control protocols like 802.11 a, b, g, and n—to have multiple and non-interoperable instrument communications as well. This contention wasn't disputed by a panel of supplier and end-user experts that included technology leaders with key roles at WINA, SP-100 committee and HART at ISA Expo last fall.

HART 7 is widely seen by end users as giving HART a new lease on life, but few see it as replacing or eliminating Foundation fieldbus and Profibus. BP's Oram has great interest in HART developments, but so far not to the exclusion of FF: "[Our] stated preference for greenfield projects will remain, for the foreseeable future, FF. But we see HART fighting back strongly."

Another end user says, "The perception is that HART is somehow simpler than Foundation fieldbus. That is half true if you only use HART for basic configuration chores and don't try to do any asset management or control."

Users who want to exploit their existing installed wired HART devices will find they'll need a board change to support advanced features such as the NAMUR NE-107 functionality, at which point a fieldbus device upgrade becomes much more competitive.

So will end users choose HART when fieldbus is an option? At INEOS, Schnipke isn't sure even enhanced HART will supplant FF where the choice exists: "With the exception of safety systems and WirelessHART, systems will have a difficult time competing with Foundation fieldbus for market share regardless of the improvements in HART 7."

A pragmatic end user at a Gulf Coast refinery adds, "I will still be looking for ways to extract continuous data from my previously installed base of HART equipment, which will not likely be replaced during my career. I'll take what I can get. but I'm not converting much—if any—of the installed base to any version of HART where I have a choice to go to fieldbus."

Ralph Hartman, engineering consultant for Saudi Aramco does not see any change in his company's FF direction. "In the hardwired world, we're Foundation fieldbus for all greenfield projects. Of course, we use HART devices for ESD, but all regulatory control is FF. We are heavily involved in FF SIS, so whenever that happens we will be using FF for our safety systems. I do not see this changing."

EDDL cooperation and host supplier recognition of the opportunity to offer distinctive support for all field device digital integration protocols holds great promise for end users. HART 7—properly supported and implemented at the host end—could render certified devices indistinguishable from FF and Profibus PA devices in terms of diagnostic support, speed and suitability for process control. But users aiming to exploit functionality at this level are still advised to test-drive prospective hosts, rather than be shocked or disappointed when the pairs get landed in the field. Host tests for HART 7 support are still a couple years or more behind similar tests for FF, but it's plausible that similar certifications will someday make the choices and capabilities clear. ∎

John Rezabek is the author of the Control column "On the Bus."