

the **EXTENSION**

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Dick Caro—One of the Most Influential Persons in the Field of Industrial Networking—Part 2

By Perry Sink Marshall, Contributing Editor



Dick Caro led the charge for adopting Ethernet as a fieldbus and as a means of achieving interoperability between hundreds of manufacturers' products, and prior to that held important positions at Foxboro and Automation Research Corporation. He's the author of three books and more than 45 papers and articles, served as chairman of the

Fieldbus Standards Committee, and was elected to the Automation Hall of Fame.

Find out more about his interesting career in the automation business, and cutting-edge, computer-control applications dating before the modern digital era. Highlights of Part 2 include:

- *Redundant Digital Control with Fiber Optic Ethernet—1983*
- *A milestone paper in 1998 that opened the door wide for Ethernet on the factory floor*
- *The real reason for the fieldbus war*
- *Dick's crystal ball on the future of U.S. manufacturing*

In Part 1 of this interview at www.ccontrols.com/DickCaro.htm, Dick Caro told his story of growing up in New York and Florida, getting into the controls business, working in manufacturing, and ultimately arriving at Foxboro where he made key contributions to some of their best selling designs. We pick up the interview where Dick left Foxboro.

You left Foxboro with a lot of experience under your belt. What did you do then?

In 1978 I joined ModComp in Fort Lauderdale as the Director of Marketing for process control. They went through an FCC investigation. The internal vultures started eating at the company and eventually destroyed it. Some of the ModComp team started a new venture called Autech Data Systems. I joined them.

I created a product line called the DAC-6000. It was a distributed-control system that we eventually presented at the 1983 ISA show. It had a microprocessor-based controller that was dual redundant with diagnostics and that is a 1002D configuration for redundancy. It had fiber optic, dual data highways that were based on Ethernet.

We chose to use fiber optics. The Ethernet cable, the Ethernet taps on cable (which was the copper version of Ethernet) were 10Base5. That is the old, thick cable material. It was completely unreliable. On the other hand, the fiber optic version of it was completely reliable. So we used fiber optic and dual data highways. We used a color graphic operator console with touch screen.

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We had people from all the instrument companies coming by for demos. They couldn't figure out how we were doing any of it.

The controller was a masterpiece. It was an all-aluminum casting with heat sink doors. There was a motor that pulled the doors closed. The cabinets were hermetically-sealed and could be air purged. This was an option that would make them intrinsically safe, if needed.

We were way ahead of our time. We tried three times to raise the \$6 million necessary to keep the

company afloat, and they all failed. The company went under. Eventually, I was recruited by Arthur D. Little in Cambridge, who was looking for a staff consultant who understood process control. That took me back to Massachusetts. I worked for Arthur D. Little for about nine years.

The ISA fieldbus committee was started in 1985. When I took the job at Arthur D. Little, I told them about fieldbus activities. That was part of my marketing duties because that was part of my contact with people in the industry.

I was involved in the cable modem project that eventually created the DOCSIS specification for Cable Labs. This was the data over cable standard.

An inventor had come to us and said, 'I want to build a VCR that will skip through the commercials on playback.' Arthur D. Little supported him with a project that created the technology to do just that which we called "Commercial Free."

We sold the technology to all the VCR companies. The high end of all the VCRs now comes with the commercial-free patent that many call "Commercial

Advance.” That was a lot of fun, learning much about video technologies.

That is a different subject, isn't it?

Something I never learned in Chem Engineering. The Cable Labs project was to develop the protocol to carry a digital video signal and being able to carry IP traffic at the same time. It was useful to have this television background.

When I couldn't work there any more, because the demands for billable work were in excess of what I could actually sell, I departed and went to the ARC Advisory Group in 1997. I joined Andy Chatha's group to handle the consulting demand that Andy was facing. I also became his network guy.

I got an opportunity, in February of 1998, to make a presentation at the ARC Conference. I presented a milestone paper in which I tackled the myths around Ethernet. It was at that conference, and in that paper, that I exploded every myth surrounding Ethernet: it's nondeterministic, it's inefficient, and the link is too limited.

I tore those myths down by detailing the use of active switches, the reliability of active switches, what they did for the network, and the benefits of full-duplex switched Ethernet in creating a completely deterministic Ethernet.

As I walked to the back of the room after the paper, there was John Pittman, Steve Glanzer and the technical steering committee for the Fieldbus Foundation. They waved me over and said, 'Can we do Ethernet instead of H2 for fieldbus?'

I said, 'I was hoping that you would ask me that. Absolutely. It's the right way to go. You just have to do a good job of it and make sure that it can't be subverted in its implementation.'

That was in February and, by the end of April, the entire project had been funded. That's how HSE (Foundation Fieldbus High-Speed Ethernet) got started, as a direct result of the paper I gave. My mission was to see the fieldbus standards work completed before the end of the century. I didn't want fieldbus work ever to go forward into the 21st century. I was anxious to have the work completed.

The work at ISA had already been accomplished, but there were fights at IEC. I took over both the ISA SP50 committee and the IEC Working Group Six chairmanships. The work had essentially been completed at IEC, but the work that the committee had done was being voted down by too many nations.

It wasn't being approved due to an organized campaign by Profibus. The Profibus group gave us all the technical reasons why they were voting against it. We countered everyone of their technical reasons by making changes in the standard, but they still voted against it. We had a lot of difficulty figuring this out.

The ultimate challenge was the IEC meeting in 1998 before the ISA conference. The delegate from Germany got

up and moved that we adjourn the meeting. I ruled him out of order. He said, 'But Roberts Rules say...' I said, 'This meeting is not run by Roberts Rules. It's run by Caro's rules. Please be seated.' We were going to respond to the negative ballots cast against the IEC standards document, and they wanted to stop it. Eventually, they just withdrew from the meeting.

Their walking out of the room gave me an opportunity to sit with the delegates who remained from the U.S., England, France, Italy, and Canada. We actually went through and wrote opinions on each of the negative votes, invalidating the technical reasons that the dissenting National Committees had given.

That weekend, it rained fiercely in Houston. It was a hurricane. I stayed in my hotel with my laptop computer and the notes from all those highly, competent people like Tom Finney, Lee Nietzel, Graham Woods, and others.

It's a great skill to have. Isn't it?

I put together a response to the international vote. I had lots of time on my hands. As you know, I can write pretty well.

When the IEC meeting was convened after that weekend, they asked for a report from each of the standards committee chairmen. I submitted a report in which I systematically, again, went through each of these international votes and said, 'These are not valid because of these reasons.'

At the end, I submitted a motion that we invalidate these negative votes because they did not follow the instructions and issue valid technical comments.

The German team immediately ran to the rules for the IEC. When in doubt, look in the rule book! They were looking for the requirement for valid technical reasons, and it was there. I said, 'Since their reasons were invalid, we must disqualify these votes.' It had to go to letter ballot. It was an amazing tactic to submit such an unexpected document when they thought they had me.

In the months before the final vote was to be submitted, I was with ARC at Interkama in Düsseldorf. My boss and I were called to meet at the conference room in the back of the booth of a large automation company.

One of the high ranking officers of that company asked us to please make sure that the current vote before the IEC passed, because that was the position that his company wanted to take. It was an eight-part document by that point, and they wanted to make sure it got approved. Wanting to keep my job, I agreed.

Because I am a man of my word, I did not contact the IEC national committees in three friendly countries whom I knew. If I had asked, they would have cast a negative ballot, and changed everything.

I had also made a comment at ISA that same year that, if the eight-part standard was approved, I would resign my chairmanship of the IEC subcommittee. I followed through on that, also. I resigned as the convener of Working Group Six. The reason being that I couldn't be involved in the ongoing support of something that I didn't believe in. That made a little bit of news.

“I said, I was hoping that you would ask me that. Absolutely. It's the right way to go. You just have to do a good job of it and make sure that it can't be subverted in its implementation.”

I remember that clearly. What kind of conversations did you have with, say, your wife about this? How did you feel about this thorny, multi-faceted situation?

I had lots of conversations, with lots of people. I decided that the honorable way was the best. I just backed out. If there was no one to leap into the breach, it might have been another story. Tom Finney was there. Tom is probably the most knowledgeable and capable network architect I have ever known. His intellect has no bounds.

For the people who aren't intimately familiar with the fieldbus wars, could you spell out why there was all this opposition? What was at stake? Could you just spell that out for people?

I might want to do that in writing because it's a very subtle and intricate thing. I'll give you the synopsis, though. (The un-cut version of this interview includes an attachment that explains all this—Ed.)

Fieldbus was not the issue. The issue was international standardization. Before the fieldbus wars, international standardization was just like standardization in the U.S. It meant that the standard was done for the benefit of the user. The user saw a commonality amongst his suppliers.

We took votes all along the way in fieldbus. Do we want to have a multi-standard, or do we want to have a single standard? Every time, the vote came out strongly for a single standard.

Euro Standards have a different mission. The mission for a Euro Standard has nothing to do with the use of the standard or the end-user. It's to make sure that governments do not impose laws or local standards which restrict international commerce between the nations.

The European-based companies goal was to change the mission of the IEC to match the European commonwealth standards mission. That is, to decrease barriers of trade between nations. It had nothing to do with developing a single standard for the end-user. Because of that, the Europeans felt the need to build multi-standards. Once a multi-standard is approved, then you can sell products based upon it in any country in the European commonwealth.

Honestly, Dick, I thought this was all about a bunch of DCS vendors and such.

No, that had nothing to do with it. It was a much bigger issue.

So there I was. I parted from Andy's employment. He hadn't supported me as I thought he should. He was definitely doing what was necessary to operate his business and to maintain his employees. It's hard to fault him for that.

He also wanted to de-emphasize consulting and do more reports. Reports are okay, but they're not fun at all. Not at all.

They're not even fun to read!

I departed from Andy with a couple of expert witness projects for which I was the consultant. Andy would just as soon not have this type of business so he gave me those cases to take with me. I started my own business about three years ago.

Tell me about your business and what you do. For that matter, give a little commercial for Dick Caro.

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CMC Associates is the name that I gave to the business because there was a parent corporation that I had for many years since my first independent stint. I incorporated in Delaware as Control Master Corporation with the initials CMC.

"Control Master" sounds like Venetian blinds or something. As a matter of fact, the website that exists at ControlMaster.com is a Venetian blind company. So, I

took CMC Associates. I was able to get the .net website. It sounds more like a business than "Control Master."

I have a website at www.CMCAssociates.net. It has pictures and bios of a few of my friends. We struggled as a business after the initial assignments. Those were both legal cases. I was the expert witness on the Opto 22 side of the suit when Schneider sued Opto 22.

I wrote my first book entitled *Automation Network Selection*. It follows on some work that I've been doing for the past several years. I discussed ASI Interface, PROFIBUS, Foundation Fieldbus, Modbus, LonWorks, ControlNet, DeviceNet, Ethernet, and PROFINet.

It has been pretty well-accepted. I think between 300 and 400 copies have been sold. That's good. It boosts my credentials for consulting.

I had another book in me. I had been working on another topic for some time and that was on wireless technology. I covered all the wireless local area networks like 802.11 A, B, and G. I discussed the emerging networks that are called "personal area networks." That's 802.15.3 and 802.15.4, and also Bluetooth, which is 802.15.1 of the same series.

I also have included considerable discussion on 3G networks now used for wireless telephony, but also have some properties suitable for use in industrial automation data networks.

The second edition of the book goes into more depth on the Ultra Wide Band. That's WiMedia. It's basically cordless USB. I talk about developments in WiMax which is long distance radio developed for IEEE 802.16. I mention the developments in RFID.

I also just completed a book with Dave Spitzer in which I've covered the three networks used for process control. That's HART, which I'm considering a network now, PROFIBUS-PA, and Foundation Fieldbus. I covered those three as a progressive set in order to show the advantages and limitations of each. The goal is to help readers make a decision on which network they want to use for a process control system. It's just for process control, not factory automation.

What do you see in the next five years for U.S. manufacturing and for the automation industry in particular? What's the big picture, what are the warning signs, good things, bad things, stuff to watch for?

Our problem in manufacturing is twofold. One problem we created ourselves. We made our manufacturing so efficient that even a fool could do it because it was so automated. Meaning, I can ship it off to someplace that has a relatively untrained labor force. We made it easy to ship overseas.

At the same time, we took the people out of it. That's what automation does. Being human, we can now complain about it.

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Do you agree with Dick Morley that automation is done because people don't want to do stuff, not that people lose their jobs because of automation?

I think it's a little different. We apply automation to correct a problem in which humans make errors because things are boring. Automation fixes that. It makes it reliable and repeatable. It makes job satisfaction greater because people aren't bored doing repetitive work. That's why we do automation. The loss of manpower is fallout from that.

As I indicated, back when I was at Ethyl Corporation during their work stoppage period, there were 700 managers and engineers doing the work of about 3,300 union people. During that time, we took notes and gave reports on the job hazards and inefficiencies being carried out by the union workers. This data also educated the engineers on how to automate a lot of those jobs.

Do you think that the outsourcing, and all the offshore manufacturing, is going to be really detrimental, or do you think that there's a bright side?

It's a dynamic situation. It's not the first time that outsourcing has been done. Shoemaking, clothing, textiles, from the 19th century, were all done in these areas—Massachusetts and New Hampshire.

Because those are labor-intensive industries, in many cases your only choices are either to automate to reduce manpower or to send it off to where the manpower is cheaper. I see all this as a continuous process.

We're simply observers in the middle of it. I don't think we can stop this any more than we can stop the wind from blowing or a tsunami from landing on a beach.

Everybody has to roll with the punches, right?

Ten years from now, people will still be working at jobs for a living. Eventually, there will be work for people. If history repeats, many of those jobs will be in areas that do not exist today and often for businesses that do not yet exist. I don't think we want to put people back into casting molten iron in the old, steel mills. I don't think we want to do that anymore.

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Note: Opinions expressed are those of Mr. Caro and may not necessarily reflect the views of Contemporary Controls.

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