

It all started on a cold night in China in 1978. Ray Hardee was sitting at his desk on the night shift and working with a new TI programmable calculator. He had just finished creating and entering a program for calculating a headloss for a single pipeline, something he did quite often. Once he finished he was amazed by how quickly it was able to produce the answers. He still had to look up an intermediate result in the Mooney diagram in the Crane Technical Paper 410, but it was much faster and accurate.

The only problem was when the calculator was turned off the program he created was erased. He had to manually enter the program each time he wanted to do a pressure drop calculation. Naturally, Hardee wondered to himself, "When will they make something that will keep the program?"

Fast forward a few years, its 1981, Carolyn Popp, and Ray were both in Indiana, Pennsylvania. Carolyn was attending some computer classes at the local university to sharpen her skills prior to re-entering the job market.

"At the time, I was taking some classes on microcomputer programming, the latest thing, and trying to juggle three children under the age of 6," said Carolyn Popp. "This was before IBM started calling them Personal Computers."

She was impressed by the power of those first personal computers and enjoyed the class. Pat Shell, an electrical engineer and friend who worked with Ray, had a TRS-80 by RadioShack® and had set up his computer to turn on the electric blanket through an infrared controller. Both Carolyn and Ray were amazed by what their friend had done. So Ray started looking at getting one of these computers, but at that time they were extremely expensive \$5,000 to \$6,000 in 1982 dollars. Ray then saw an advertisement for an Osborne OS-1, it was only \$1995 and included a Z-80, 8 bit 2mHz processor with 64Kbytes of memory and two 5.25" floppy drives, a built in monitor, and all the software you would need to start a computer business.

Ray and Carolyn started developing PIPE-FLO version 1, taking all the formulas in the Crane Technical Paper 410 and putting them on the computer. The first program had a set of tables for the pipe material, along with the valves and fittings; there was also fluid properties for water, with the ability to add your own fluids. The program was designed so you could create a piping system with 16 pipelines. When they really started developing the program, Ebasco Services, Ray's employer at the time, moved from Pennsylvania to the Satsop Nuclear unit outside Elma, WA.

Ray went first to check out the area, and Carolyn stayed in Indiana, PA until school was out. She kept the computer, and continued to work on the program. They had the PIPE-FLO design meeting over the phone, and Ray would check out the progress when he got back to Pennsylvania.

Ray submitted an outline for an article to Power Magazine on how micro-computers could be used by engineers to solve real life problems. They accepted the outline, and with a magazine article to his name, Ray was a computerized piping expert. After Carolyn made it to Washington, they got settled in and started making real progress on PIPE-FLO. After four months of development they took their program to an engineer that was selling stress analysis software in Seattle. He had one of his customers look at the program and come back with some suggestions. On the way home from the meeting, Carolyn and Ray were busy on PIPE-FLO version 2.0.

With PIPE-FLO version 2.0, a user could store up to 100 pipelines into a database. The pipelines could be saved and recalled for later work. Ray and Carolyn improved the reports and made it so the customers could create their own pipe size tables. After another month PIPE-FLO version 2 was finished. They also used a software development tool that let them easily configure the program for the wide range of computer terminals that were available.

“We were in business with a program, but we didn’t have any customers,” said Hardee. “See we first had to sell the prospect on the idea of buying a micro computer and then to buy our software.”

About this time, IBM® released the Personal Computer and the TV was full of IBM PC ads with Charlie Chaplin showing us all why we needed a PC. Now that Ray or Carolyn didn’t have to convince prospective customers they needed a computer, they could concentrate on developing the software and selling it.

Ray and Carolyn finally took out a business license for Engineered Software in 1982. About the same time a 20 year old Bill Gates was starting up his company, they had about 30 employees, Engineered Software, Inc. (officially named) had two employees.

Rather than learn how to sell software, Ray and Carolyn decided to create a new program. ORI-FLO was developed to size flow meters and orifices. Much of the information about the pipe and fluid needed by ORI-FLO could come from the “Pipeline Database” created by PIPE-FLO. ORI-FLO 2.0 (there never was an ORI-FLO 1.0) was finished in about one month and they had another product.

Once again, rather than learn how to sell software, they developed another program called SYS-FLO. Using this program, you could take the pipelines designed by PIPE-FLO, insert them into the Pipeline Database, and connect them together into a series segments and parallel segments. You could also put in a pump and say how much flow rate you wanted, the program would calculate the pressures along the way, and the flow rates in the parallel segments for you. Carolyn had to create screen in which you could choose a series or parallel segment and then enter the pipe lines for the pipeline database. This was a really cool program and after a couple of months they had their third program.

Since Engineered Software had three programs that worked, together on fluid piping systems they called the programs together, the “FLO-SERIES.” Now they figured they needed to sell some programs because after all, to call themselves a business they needed some paying customers.

In 1984, the PC was the talk of the town and KIRO (the local Seattle TV and Radio station) decided to have a computer show at the Seattle Center. Ray figured that since their customers needed to have a computer, why not go to a trade show attended by people who were interested in computers.

“We got a sign painted and it looked great we put it on ¾ inch marine plywood so it would last, I believe it cost us \$50,” said Hardee.

They took their computers (now they had two) to Seattle and exhibited in the trade show. It lasted from Thursday to Sunday and was open from 10:30 am to 7:30 pm. Carolyn and Ray both spent the whole time in the booth. After four days showing the software to fellow computer geeks, mothers who wanted to make sure they purchased the right computers for their kids, and an occasional engineer who found our booth, they got a handful of leads and felt tired but were pleased. During that show, they made an appointment to demonstrate the program to the Puget Sound Naval Shipyard and that is where they made their first big sale.

After that first show, they decided to start advertising in the *Osborne User Group* magazine, and once again were advertising to engineers that already had computers. That gained a couple of sales to Bechtel, their second customers.

The next trade show they went to was hosted by the American Society of Mechanical Engineers, and had to do with piping systems. Really, pipe stress, but at least it was visited by engineers involved with piping systems. They didn’t have any booths, but they did have a poster session so they put their trusty Engineered Software sign of ¾ inch plywood, in the poster session and directed attendees to their suite. It was really a room in the conference hotel and they had a large number of prospective customers stopping by. They liked what they saw but they wanted a more flexible program one that would do network of pipelines.

Engineered Software started working on NET-FLO, their fourth program. It would allow you to build a network of pipelines, pumps, and components and calculate the balanced pressures and flow rates for each pipeline in the system. They got a copy of the source code of the University of Kentucky KY PIPE program. Carolyn spent about two months understanding how the loop tracing and calculation algorithms worked. For the next three months she worked on the program during the day, and Ray checked the results for her at night. Carolyn would fix the bugs as Ray found

them. Both were working on nights and weekends so, after four months, NET-FLO was complete and they had developed an easy to use network analysis program that was fast and provided accurate results.

“We really felt we had a winner that the market would like,” Hardee said.

NET-FLO got the pipe information from the Pipeline Database created by the PIPE-FLO program. Now there was four programs in the FLO-SERIES so they started focusing on selling some software.

Employing a few high school students to put in pump curves with Ray while Carolyn continued to develop and add more functionality to the programs. During that time, the FLO-SERIES version 3 (comprised of PIPE-FLO, NET-FLO, PUMP-FLO, CON-FLO, and ORI-FLO) became a set of DOS programs which together included the basics of what we now call PIPE-FLO. Ray did all of the sales & marketing, and Engineered Software started to become known among engineering firms.

After working at the Satsop plant in Elma for two years, Ray finally got the word that WPPSS ran out of money and they were going to be closing the plant.

“I had a choice of staying with Ebasco and moving, or quitting the day job,” said Hardee. “I chose to quit the day job and I started working for Engineered Software full time with Carolyn.”

Around 1988, Engineered Software landed a contract with Aurora Pump to do a custom pump selection program under Windows (version 1 just released), which involved completely rewriting PUMP-FLO in a new language and OS. This was a big turning point in development and increased their good exposure.

In 1989, Ray and Carolyn moved their business to a slightly larger office in downtown Olympia, Washington. Over a period of six years, Engineered Software grew to a company with seven employees operating in 900 sq. ft. Two years later, and a combining of PIPE-FLO with NET-FLO, Engineered Software was now offering their first Windows® version of their software. At this point Windows still did not look like it does today, but Carolyn was aware that the future of software was heading towards compatibility with Microsoft’s operating systems.

In 1996, Engineered Software had built and moved into a small office in Tumwater, Washington. First occupying only half of the building, then slowly over 10 years growing into a company with over 24 people. Working with two interns, they converted the remaining FLO-SERIES programs to the Windows interface, which included the first FLO-Sheet interface for PIPE-FLO and it was named FLO-SERIES version 5. Sales started moving along, but they were still figuring out how to make Engineered Software, a successful company. They established a software development group and a sales force, and every year showed steady growth.

By this time, things were looking pretty great, so the Engineered Software team offered their programming expertise to the folks at Crane Valve North America. Engineered Software had the perfect small-scale program for Crane to use as their Flow of Fluids Companion software.

“I think the people at Crane were ready for a program that was reliable, and came with better technical and engineering support,” Popp said. “What we were offering was a stable program that used the calculations outlined in their TP410 document. It couldn’t have been a better fit, and we were able to provide them with a program that had more functionality than before, because our software is compatible with the PUMP-FLO selection module.”

During this period, Carolyn and Ray were also developing specialized programs for compressible gas piping systems and paper stock systems. While making these product additions to their catalog of software programs, they were also focusing on marketing their PUMP-FLO program more heavily.

In mid-2000, Big Machines agreed to work on an online branded enterprise version of PUMP-FLO, that they could use internally and as a sales acquisition tool. This was a huge deal for Engineered Software, and Ray and Carolyn decided it was time to celebrate.

2000 was a strong year for Engineered Software, and was capped off with the prestigious Plant Services “Product of the Year Award” for both of their programs PIPE-FLO and PUMP-FLO Web. Ray decided that once they could prove

their software was award worthy, they could take a step back and re-evaluate the whole packaging of the software products.

“Windows had gone to a 32-bit format, and we needed to bring PIPE-FLO through next stage of software evolution,” Popp said.

And so, a complete rewrite was done of PIPE-FLO into 32-bit, including all functionality of PUMP-FLO, CON-FLO, ORI-FLO into one single program. This compilation was now called PIPE-FLO Professional and ORI-FLO and CON-FLO are no longer sold separately. PIPE-FLO Compressible and Stock programs now also have the functionality that the PIPE-FLO Professional has, but the calculation methods appropriate for those specific types of systems.

By this point PUMP-FLO was on a roll, and the big deal with Big Machines solidified the IDEA that PUMP-FLO could sustain itself, so in early spring of 2002, Ray and Carolyn agreed to make PUMP-FLO Solutions into its own business unit.

“The PUMP-FLO product line was making quite a name for itself, and we wanted to offer our pump selection tool to a broader audience,” Hardee said. “We wanted to have a separate team dedicated to developing and marketing PUMP-FLO with its own identity, because really it was becoming a leader in the industry. We had over 65 different pump manufacturers on board already when we decided to offer a free web version.”

With ongoing success in the pump selection and piping system design software industries, Engineered Software was looking for new avenues to increase their business alliances and broaden their audience. Finding a willing partner once before with the Crane Valve North America company, Engineered Software once again struck an agreement. This time, Crane gave Engineered Software the authorization to produce, market, sell and distribute Crane's Technical Paper 410 The Flow of Fluids through Valves, Fittings, and Pipe.

“So not only were we providing the software, but also selling, supporting and upgrading the software package as well as producing, marketing, and distributing their Technical Paper 410,” said Hardee “Another exciting change in our repertoire.”

“Yeah, it was a big departure from our software production methods,” agreed Popp. “We were really much better equipped to handle all the aspects of the marketing and selling process for the TP410, what we were not quite ready for was the actual production of the book, and the quantity we would be printing on a regular basis. We actually purchased the printing press machine that our printer is using still to this day, to print our large quantities of the technical paper.”

In August of 2006, business was booming and so was the size of the staff. So Engineered Software had a new 7,500 square foot, official corporate headquarters built in Lacey, Washington. At move-in time there were 20 employees on site, who packed up their desks and settled in to a new, spacious, state-of-the-art facility, complete with a better phone system, new conference room, and foamy soap dispensers in the restrooms.

With room to grow, it was not long before hiring began again. Less than 6 months after moving in, five new employees joined Engineered Software. A new building and more staff meant Ray and Carolyn were looking toward the future, but couldn't help being a little nostalgic.

“We started looking at our old marketing materials, and decided we were way over due for an image makeover,” Hardee said. “We had had our same logo for over 20 years!”

So, with the help of Ray and Carolyn's neighbors at the Williams Group, the Engineered Software logo was brought into the 21st century, just in time for the latest releases of PIPE-FLO and PUMP-FLO. PUMP-FLO had come a long way from its meager beginnings, but with world-wide appeal, it was decided that the program would be offered in four new languages, French, Spanish, German, and Italian. As Ray well knew, the language of engineering is universal, but changes were still made to much of the menu and program items so this was no small accomplishment.

2007 marked the 25th Anniversary of Engineered Software's inception, with over 25 employees, 3 business partners and more than 15 products and services, Ray and Carolyn felt they earned a celebration. Using this anniversary as an opportunity to reflect back on memory lane, recalling that the first PIPE-FLO program was sold to a customer in 1983 and they are still a customer today. During the company party, Ray brought out the original Osborne OS-1 computer the first PIPE-FLO was built on.

"With the right coaxing and finessing, the computer still works," said Popp. "It's a part of our history, and people need to see where we have been to see how far we have come."

In an effort to show their environmental conscientiousness, and their desire to shape the future of their industry. Engineered Software became a sponsor to the educational organization, Pump Systems Matter™ in an effort to reach out to the pump systems industry about energy efficiency. Because PIPE-FLO is used to design piping systems and select appropriate pumps based on the systems' design, Ray thought it was a perfect match for their system efficiency message. Carolyn also looked internally for ways to be more efficient at the headquarters, including having an optimized server network for the employees to work off, and recycling of cardboard and paper products.

Early in 2008, after months of planning, Ray decided that Engineered Software would have a new training division, offering classes specific to the piping system and pump industries. Ray, himself would teach the first class on piping system basics, based on the complete lack of such a class available. Early on, when Ray had been instructing the FLO-Master PIPE-FLO seminars, he would receive requests by attendees for a more in-depth class on the basics of designing piping systems. FLO-Master discusses briefly, the basics of design, but focuses mainly on how to use PIPE-FLO to do the calculations.

"No one else was offering a fundamentals class on piping systems, and people wanted more information on the principles behind what goes on in a piping system," said Hardee. "So many people were going to benefit from a class like this because, it was specialized, and piping systems are everywhere, in every factory and plant. And with every piping system, there is someone who must understand what is happening in it, and perform maintenance on it."

To add to the class, Ray also wrote an accompanying book. This was his first technical book, and was a labor of total love. The book took less than a year to write, but was years in the making, since he had been planning on and researching shortly after visiting Valero in Louisiana in the summer of 2006 where Ray did a custom piping system basics training.

Meanwhile, back on the PUMP-FLO home front, PUMP-FLO.com was reaching record numbers or registrations. In June 2007, over 100,000 people had registered on PUMP-FLO.com and by August of 2008, there were over 150K. Engineered Software had agreements with over 100 pump manufacturers and offered well over 100 catalogs for use in the PIPE-FLO and Flow of Fluids programs.

With the growing success of the training class, Michael Volk, P.E., a close associate and friend of Ray and Carolyn's offered to provide his pump training class to the new Fluid Fundamentals training catalog. It would not be long before Ray would be easing his way out of the training circuit, and working his team of engineers into the training positions.

After nothing but remarkable growth, both Ray Hardee and Carolyn Popp remain involved in the business they started over 25 years ago. There have been new business units created, wide product diversification, and major staff increases. With each new progression, Engineered Software has only grown in strength as an industry leader and innovator.

"Our customers keep coming back because we are reliable," Hardee said, "they have been able to rely on us to provide top notch products and services since we began, and that is they keep coming back. We keep exceeding their expectations."