THE MOD SQUAD: PROCESS AUTOMATION AT DOW

What, Why and How Dow Chemical Does Process Automation Differently Than Everyone Else
by Margaret Walker, Ed Sederlund, Jerry Gipson and Eric Cosman, Dow Chemical Co.

More than 30 years ago, the Dow Chemical Co. embarked on what ultimately evolved into a global corporate initiative: to develop and broadly leverage a standardized, highly integrated process automation system, incorporating basic process control, process information and safety-system functionality. Based on what we wanted to accomplish, and a lack of commercial offerings at that time, we developed several proprietary solutions, including a process control system that came to be known as MOD, which is short for “Manufacturing Operating Discipline.” This article describes our journey to develop our own process control system, discusses lessons learned, and explains why we took the path we did.

Founded in 1897 by Herbert H. Dow in Midland, Mich., the Dow Chemical Co. is a global leader in science and technology, providing innovative chemical, plastic and agricultural products and services to customers in 175 countries. From the very beginning, continuous improvement has been at the heart of the company, and forms the essence of its mission: “To constantly improve what is essential to human progress by mastering science and technology.” To achieve this, we’re committed to the principles of sustainable development. While it might sound lofty in some circles, this underlying philosophy has been an instrumental driver in our process control journey from the beginning.

The roots of our process automation philosophy go back to the 1960s, and are based on our operational strategy. Consistency and sustainability are key elements of that strategy. As a global company, it’s important to operate facilities in the same way, every time, to achieve consistently high quality, as well as process reliability and repeatability of best practices. We were striving for true “operational excellence” many years before it was coined by industry analysts.

Operational excellence includes safety performance, which was and is a key focus for Dow. We’re passionate about it. Protecting people, the community and the environment are non-negotiable priorities in our corporate culture. We must operate our plants safely, and in the same way, every time. Our “Vision of Zero” translates to zero incidents, injuries, illnesses, accidents and zero environmental harm. So our safety practices need to be repeatable and re-deployable as well.

We’re also driven to develop our own solutions by our engineering culture. We’re encouraged to look at problems and solutions differently. We ultimately integrate design, control
and safety as a standardized system because we need solutions that improve the process. We design the solution around the process, not the process around the solution. Which element drives the development process is an important distinction here. You size the shoe to fit the foot. You don’t change the size of the foot to fit into the shoe. So, the needs of the process and our ingrained operating discipline are what ultimately create the solution. Our Manufacturing Operating Discipline (MOD) series process automation system was designed not by automation engineers, but by chemical engineers, who were intimately familiar with the intricacies of the process.

This was the challenge, and we absolutely needed to accomplish all of it. However, in the beginning, commercially available process automation systems didn’t give us the capability that we needed. Technology was available that could be applied to the problem, and we developed several solutions based on general purpose computers and operating systems. Over time, we were able to develop a system that met our needs. In fact, Dow was the first company to certify a process control system with logical separation of the safety and automation functions in a common hardware platform. However, we didn’t exactly plan it that way. The driving force behind this was our passion for process safety, our operating discipline and the need to simplify the automation platform. We weren’t looking to invent something revolutionary. A confluence of process automation deficiencies in the market and the right people with the skills, needs and management support set the stage for Dow’s proprietary automation system.

In the late 1960s, all the plants we were familiar with operated with individual loop instrumentation, or even manually in older plants. Early efforts at automation were frustrating and cumbersome due to hardware incompatibilities and complexities. More time was spent dealing with keeping the control system running than was spent improving plant operations. This had to change. What was needed was a standardized, re-deployable process automation solution that supported our goals of overall consistency, productivity improvements, global operating discipline and innovation, all while maintaining high safety performance. The common thread throughout was our passion for process safety and this operating discipline.

Levi Leathers’ Operating Discipline Vision

One of the greatest influences on MOD’s early development was Joel Franklin Monroe (Levi) Leathers, a research and
development pioneer, who became Dow’s executive VP (Figure 1). Levi was a larger-than-life individual who had a tremendously positive impact on those around him, both personally and professionally. You may be fortunate enough to encounter someone like him once in your life.

In the early 1960s, Levi was R&D director and later general manager at Dow’s Texas Division. Under his direction, new processes and vast improvements to existing processes came into being. His words ring as true today as they did then: “If it doesn’t work, there is a reason why. If it does work, there is a way to make it better.” He embodied Dow’s passion for safety and operating discipline, and planted the technological seeds that brought them together. He didn’t know all that had to be done to achieve this goal, but he knew how to get people excited about the idea. The term he used to express his concept was “Operating Discipline.”

Levi shared his vision by traveling around the company to Texas, Midland, Sarnia, Canada and many other Dow sites worldwide. He didn’t just talk to control engineers, but to people at all levels, including process and instrument engineers, manufacturing, plant or line people, business leaders and senior management. Levi wasn’t the actual technology inventor, but his influence is easily seen in the early development efforts that began during this decade.

**Converging Activities**

Over the years, there were technology development activities throughout Dow, each addressing a different aspect of the overall automation opportunity. These activities ranged from creating process information systems to developing closed-loop control applications. Ultimately, they all converged to one set of systems, but this took several years. Information sharing between engineering teams at multiple sites wasn’t what it is today. Travel between sites was limited, and the technology that today facilitates information exchange between sites and work teams that we now take for granted wasn’t a reality back then.

**MOD 1 is Born**

One major activity began about 1968 in the Midland Analog Simulation Facility, which was seeking better production process control. By perform-
ing differential equations on analog computers, researchers found they could simulate any conceivable control strategy. As a result, analog simulation was widely used to perform studies that would determine the best control strategy for controlling a unit operation or an entire plant.

However, the development of analog simulation also led to some frustrating times. Existing hardware, such as panel-mounted conventional controllers, often became a barrier to implementing the best process control methods. Compromises also had to be made to fit existing hardware.

Despite these constraints, some process control ideas were implemented on industrial analog computers built to withstand hostile environments in the field. However, while they had the flexibility to implement control ideas without hardware barriers, analog computers were costly and very limited in capacity. The logical question was: how to implement the technology of a large analog computer in the field at a much lower cost to the company?

The answer was MOD 1. Started in 1969 on a batch distillation column, MOD 1 resembled an analog computer, and had similar logic and computing components. It had approximately one-quarter of the power of the present MOD 5 computer, but it was the foundation for sequencers, alarms, flexible analog and digital control—the basic ideas for automating a chemical process. Built by Taylor Instrument Co., which is now part of ABB, the first MOD 1 cost $85,000.

This Operating Discipline philosophy was implemented using the “sequencer” concept. The importance and value of subdividing the entire plant into unit operations (sequences), and then subdividing the time up into steps for each sequence boggles the mind. Plant people could now think about, document, and automate all of the actions required to operate a plant, including start-up and shut-down. The control system would then provide relentless enforcement of the best way to run the processes.

These ideas often met with opposition because they were viewed as impractical or unachievable. The trench-by-trench effort to get the plants to accept and use this level of automation was fought for many years, and is still being fought in some instances. However, the favorable economic impact of the successful implementations were felt throughout our company.

**MOD 2 Moves to Modular Mode**

By 1970, MOD 2 was created to reduce costs, and move from a stand-alone to a mode-modular system. It was the first process control system with a standard system packaging method. MOD 2 also used digital modules from Digital Equipment Corp. and hardwired logic cards. However, MOD 2’s analog function modules were designed internally.

**MOD 3 Increases Control Capability**

Coming into general use in 1972, MOD 3 was developed to increase system control capability, and reduce overall costs. Some rewiring was required to change the control logic. Installation of a MOD 3 in a Latex plant in Sarnia, Ontario, was the first use of MOD’s concepts outside the Michigan division.

MOD 3 used the first all-digital CPU, which was called the Alpha 16 or the Naked-Mini. This CPU was made by Computer Automation Inc., and had 4 KB to 32 KB of memory. MOD 3 also was the first process control system to use DOWTRAN, a computer language for end-user programming.

**MOD 4 Goes Global**

MOD 4 followed in 1975. It was the first process control system to perform all temperature and flow calculations in its software. MOD 4 expanded the I/O capability of previous MODs, and displayed values in engineering units, instead of percentage of full scale operation. MOD 4’s LSI-2 CPU expanded memory to 80 KB, and was again built by Computer Automation. Mod 4 finally made it possible to backup all inputs and outputs. Installation of a MOD 4 in the Methocel plant in Stade, Germany, was the first use of MOD systems outside of North America.

**MOD 5 Brings the Best Together**

Dow began using MOD 5 in 1980. Most of the first process control concepts remained in the MOD 5, but were greatly enhanced by the accumulated knowledge from implementing the system worldwide. MOD 5 represents hundreds of person-years of experience for automating and controlling processes accumulated over a mere 16 calendar years.

MOD 5 also represents the true col-
laboration of Dow’s multi-discipline work teams (chemical engineers, process automation, instrumentation, etc.). The MOD series development was a pivotal endeavor that linked our technology center philosophies with our operating discipline. We understand better that cooperation between research (get the right process), engineering (use the right equipment), maintenance (fix it once, never again), production (optimized and safe operations), business (automated scheduling, shipping, etc.) and many other groups must occur and improve for our company to survive and excel.

We really started to see tangible, operational benefits with MOD 5, including repeatability, as well as consistency and productivity improvements. Repeatability of best practices was extremely important because it enabled us to operate our plants safely, day in and day out, no matter what else we were doing. It helps us to do it the same way, every time.

Consequently, in the mid-1980s, Dow decided to implement MOD 5 globally. The standard systems approach used here was extremely powerful because it means anyone familiar with a MOD 5 system can immediately relate to the MOD 5 hardware and software running a process anywhere in the world. As of 2000, we had 1,500 systems installed and more than 400 information systems in place.

In the 1990s, there were several enhancements to MOD 5. A control computer was provided that physically combined control and safety functions in the same hardware platform. However, these functions were logically separated. This version of the system was SIL 3 certified. Dow was the first company to certify a process automation system with logical separation of the control and safety functions.

There were also major projects to address the human interface to the control system and the information management functions. The MOD Operator Station provides a standard graphical interface to the process control system, as well as an integrated environment for control programming development. A single standard information system and process historian was created by combining technology from several products developed previously.

**Significant Results**

By combining our best technology, we’ve seen tremendous productivity benefits added to fulfilling our operating discipline and safety performance goals. We reduced control strategy development time by 45%, and reduced support costs by 50%. Process startups are automated and coordinated across multiple unit operations. Alarms are “intelligent” in the sense that they reflect the state of the process, rather than just a deviation from a limit. Batch processes are fully automated, resulting in reduced cycle times.

Embedding our operating discipline concept in the automation system also helped us achieve our environmental, health and safety (EHS) goals. All these performance improvements contribute hundreds of millions of dollars to our businesses.

**Looking Ahead: New Sustainability Options**

Of course, all strategies must adapt. So, the time came when we realized it wouldn’t be cost-effective to continue to invest in proprietary hardware and software systems. In early 2000, we decided change was necessary. While we wanted to preserve our process automation expertise, we knew that we didn’t want to be hardware providers, and so we began to look at other options.

The next article in this series will describe our quest to find a sustainable process automation solution that could take us into the future. MOD 5 would be a very tough act to follow.

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More than 30 years ago, the Dow Chemical Co. embarked on what ultimately evolved into a global corporate initiative: to develop and broadly leverage a standardized, highly integrated process automation system, incorporating basic process control, process information, and safety-system functionality. Based on what we wanted to accomplish, and a lack of commercial offerings at that time, we developed several proprietary solutions, including a process control system that came to be known as MOD, which is short for “Manufacturing Operating Discipline.” With the MOD 5 System, Dow was the first company to certify a process automation system with logical separation of the control and safety functions. Our development approach served us well for many years, but we reached a point where it was no longer cost-effective to develop our own system. Part 2 of this three-part series describes Dow’s transition from our successful, home-grown solution to a commercially developed solution, including what went into the decision process, why we needed to change, and how we grew and nurtured a truly collaborative, technical relationship that will take our operating discipline forward.

From the beginning, continuous improvement has been at the heart of the Dow Chemical Co., and forms the essence of its mission today, “To constantly improve what’s essential to human progress by mastering science and technology.” To achieve this, we’re committed to the principles of Sustainable Development. As we discussed in Part 1 (“The Mod Squad: Process Automation at Dow,” Control, Feb. ’06, p. 68), this underlying philosophy has been an instrumental driver in our process control journey.

The roots of Dow’s process-automation philosophy go back to the 1960s, and are based on our operational strategy. Consistency and sustainability are two elements of that strategy. As a global company, it’s important to operate facilities the same way, every time, to achieve consistent high quality, as well as process reliability and repeatability of best practices.

Of course, safety performance also is a key focus for Dow. Protection of people, the community, and the environment have always been non-negotiable priorities in our corporate culture. We must operate our plants safely every time, as well as the same way every time. Our “Vision of Zero” translates to zero incidents, injuries, illnesses, accidents, and zero environmental harm. So our safety practices needed to be repeatable and re-deployable, too. All of these elements make up our Operating Discipline (OD).

Initially, commercially available process automation systems didn’t give us the capability we needed. Technology was available that could be applied to the problem, and we developed several solutions based on general-purpose computers and operating systems. As we gained experience with these systems, it became evident there were significant shortcomings when applied to process automation and customer needs. Over time, we developed the MOD 5 system to meet our needs.

For nearly 30 years, and with more than 15 patents related to MOD technology and TUV Safety Integrity Level (SIL) 3 certification, we enjoyed continued success in fulfilling our OD with our proprietary MOD System series. It grew from an analog system at one site in the 1960s to a globally deployed, standard process control system with 1,500 systems installed throughout Dow by the year 2000. Over the years, the MOD series system delivered tremendous productivity benefits to Dow. We reduced the time to develop control strategies by 45%, and reduced support costs by 50%. Process startups were automated and coordinated across multiple-unit operations. Alarms were “intelligent,” reflecting the state of a process, rather than just a deviation from a limit. Batch processes were fully automated, resulting in reduced cycle times. Embedding the OD concept in the automation system also helped us achieve our Environmental, Health and Safety (EH&S) goals. All of these performance improvements jointly contributed hundreds of millions of dollars in value to our businesses.

Exploring New Sustainability Solutions

In early 2000, however, we realized it wouldn’t be cost-effective to continue to invest in proprietary hardware and software systems. Our efforts to develop the next version of the MOD system, MOD 6, proved to be much more time and cost intensive than we anticipated. MOD 6 development began in 1987, and envisioned a triple-redundant, synchronous architecture built on dual-redundant synchronous architecture learnings from MOD 5.
The strategic error in MOD 6’s development was building our own computer and communications application-specific integrated circuits (ASICs) and related software and development tools. MOD 6 was successfully demonstrated in 1998. However, rapidly changing computing and automation technologies, such as changes in networking, connectivity, communication protocols, integrated systems, real-time information access, and embedded intelligence made it difficult for us to incorporate all of them into the current development cycle, which became more unwieldy to manage with each passing day. It seemed that we’d come to the crossroads where commercially available technologies were at long last catching up to us.

External markets also conspired to force this change. As a global manufacturer, our new plants were bigger and more complex than ever. We also were expanding rapidly. The expectations for capital utilization, energy use, overall efficiency, and throughput were higher. And, the need for information integration between processes, plants and people were growing more sophisticated. The performance pressures in the global economy were intense, and, just like everyone else, we needed to find ways to do more with less. The need to continuously improve productivity was always there—every cent matters to the bottom line. So, it was imperative that our plants run smoothly, efficiently, and without interruption. At the same time, we had to accomplish all of this while being true to our OD, and make sure that our solution was sustainable going forward.

Consequently, it just no longer made business sense to continue to develop and maintain our own process automation system. We needed to focus on our core manufacturing business. While we wanted to preserve our process automation expertise, we knew we didn’t want to be providers of hardware and software, so we began looking at other options. Some of the commercially available solutions looked like they had the potential to develop into something that could work for us, but going this route first required a lot of investigation, homework, and soul-searching. It isn’t easy to give up a job that you’ve been doing very well for more than 30 years, and just hand it over to someone you don’t know. Yet we knew, for pragmatic reasons, it had to be done.

The culture, the knowledge, and the passion for process safety were already ours. That wasn’t going to change in this transition. What was going to change was the platform. It just so happened that our first platform was the system we invented. So, the goal was to slide that platform out, slide in another platform, and allow the culture to continue forward undisturbed. We needed to find a solution platform to meet our needs, as well as a process automation partner that would share our vision, goals, and philosophy.

**Critical Requirements: “The Crown Jewels”**

To be considered as a possible solution, a commercial system had to align with our process automation wants as well as our needs. Once we decided to pursue a commercial option, we defined more than 400 requirements for this system that addressed our need for sustainability going forward. Long-term commercial availability, cutting-edge technology, and forward-looking solutions were all essential criteria. We absolutely needed a process control system that would take us successfully into the future, be deployable on a global scale, leverage commercial standards as they became available, and be on a platform that Dow could use as a standard at any plant anywhere.

We expect our plant assets to run for 40-50 years, so our process control systems need to be as sustainable as the rest of these assets. A commercial system also would have to meet our increasing need for knowledge management, while remaining true to our process engineering culture. It
DOW LEARNINGS PART 2

had to be able to shape our future engineering culture, just as the MOD System had since the 1960s.

After agreeing to go commercial, we explored various ways to collaborate with external suppliers. Following our initial attempts, we hired an objective, third-party consultant to work with us in the evaluation and selection process, and help us define our requirements. Of course, after all our team had achieved with the MOD series, our expectations were much higher and our wish list far more detailed than a typical automation customer. We knew exactly what we wanted. Were what you might call an extremely knowledgeable consumer.

Based on our list of 400 requirements, Dow defined 32 high-level criteria, affectionately known as “The Crown Jewels.” The consultant provided a short list of recommended candidates for Dow to approach. We did an extensive on-site evaluation based on our requirements for each recommended company, and met with their executive management, technology officers, and development teams.

“It was unique to meet a customer with such a detailed list of functions outside the normal market standard requirements. This led to a number of internal discussions, including how to fulfill these functions and the technical needs for all of them,” recalls Frank Duggan, currently senior vice president for ABB’s Group Account Management.

“On the other hand, we were dealing with a partner with a deep understanding of systems. If we could fulfill the rest of Dow’s requirements, we felt this could become our competitive differentiator for the industry.”

ABB: A Shared Vision

ABB was one of the companies on our short list. We spent five days with them during the onsite evaluation. One thing we told them upfront was that we didn’t want to see any “smokescreens” or ethereal vision presentations. While vision is extremely important to us, we also had an immediate need for a sustainable solution. We couldn’t afford to wait for something that might materialize someday.

Consequently, we met, we visited, and we sat through numerous company overview and technical presentations, some quite boring to be perfectly honest. On the fifth day of their visit, ABB’s presenters showed us their IndustrialIT technology, which was being developed as the heart of their Extended Automation System 800xA. At that point, we knew that we’d found the commercial solution that would take us into the future. We saw in that one day’s presentation exactly what we were seeking—the integrated environment, safety systems, and repeatable engineering solutions. It was all there. IndustrialIT had the ability to integrate multiple systems and plants into one environment, as well as system flexibility, integration of databases, common operating views, and engineering functionality. It was right in line with what we needed. The alignment with their direction compared to where we wanted to go also came together nicely.

So, we’d found the commercial technology that could accomplish what we needed to continue fulfilling the Crown Jewels. We could use this platform to leverage our experiences and learnings with the MOD System’s services. However, while the technology was a crucial ingredient to making the conversation happen and implementing the solution, much more was needed to help Dow and ABB’s relationship succeed.

Consequently, even though we’d found the technology we thought could take our OD forward, the really hard work was just beginning. We needed to lay the foundation for a truly collaborative relationship, and let go of our own sole-system development mindset at the same time. The next article, Part 3, will discuss what was involved in building a close working relationship with ABB, and the elements that are essential to starting and sustaining any collaborative relationship that yields results.

For more information on Dow’s patents related to the MOD technology and TUV SIL 3 certification, go to http://www.uspto.gov/patft/index.html.

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COLLABORATIVE PROCESS CONTROL: THE DOW/ABB STORY

All it takes is open communication, honesty and a bit of time to draw pictures. Part 3 of a series on the collaboration between Dow Chemical and automation vendor ABB.

Margaret Walker, Ed Sederlund, Jerry Gipson and Eric Cosman, Dow Chemical Co

Over 30 years ago, The Dow Chemical Company embarked on a project that over time evolved into a global corporate initiative: To develop and broadly leverage a standardized, highly integrated process automation system, incorporating basic process control, process information and safety system functionality. Based on what we wanted to accomplish and a lack of available commercial offerings, we developed several proprietary solutions, including a process control system known as MOD—“Manufacturing Operating Discipline.” With the MOD 5 System, Dow was the very first company to certify a process automation system with logical separation of the control and safety function for SIL 3 applications. Our development approach served us well for many years…but we reached a point where developing and supporting our own system was no longer cost-effective.

After a thorough review and selection process, we chose ABB to provide the technology solutions to take our operating discipline forward. The formal selection process had concluded, but the really hard work was just beginning. We needed to lay the foundation for a true collaborative relationship and, at the same time, let go of our own sole-system development mindset. This article will discuss what was involved in building a close working relationship with ABB and the elements that are essential to starting and sustaining any collaborative relationship that yields results.

From the very beginning, continuous improvement has been at the heart of The Dow Chemical Company and is the essence of its stated mission today: “To constantly improve what is essential to human progress by mastering science and technology.” To achieve this, we are committed to the principles of sustainable development. As we discussed in Part 1 of this series, this underlying philosophy has been an instrumental driver in our process control journey from the start.

The roots of our process automation philosophy go back to the 1960s and are based on our operational strategy. Consistency and sustainability are key elements of that strategy. As a global company, it is important to be able to operate facilities the same way every time to achieve consistent high quality, process reliability and best practices repeatability.

Of course, safety performance is a key focus for Dow. Protection of people, the community and the environment have always been non-negotiable priorities in our corporate culture. We must operate our plants safely every time, and the same way every time. Our “Vision of Zero” translates to zero incidents, injuries, illnesses, accidents and zero environmental harm. So our safety practices needed to be repeatable and redeployable as well. All of these elements made up our operating discipline.

At that time, commercially available process automation systems did not provide us with the capability that we needed. For nearly 30 years, we had enjoyed continued success in practicing our operating discipline with our proprietary MOD System series. It had grown from an ana-
log system at one site in the 1960s to a globally deployed standard process control system with 1,500 instances installed throughout Dow by the year 2000. Over the years, the MOD series system had delivered tremendous productivity benefits to Dow.

However, in early 2000, we realized continuing to invest in proprietary hardware and software systems would not be cost-effective. For a number of reasons discussed in Part 2 of this series (Control, May 2006), it no longer made business sense to continue to develop and maintain our own process automation system. We needed to focus on our core manufacturing business. After we agreed on our strategy to go commercial, we engaged an objective third-party consulting firm to work with us in the initial evaluation and selection process. It also helped us define our requirements—no small challenge because after all our team had achieved with the MOD System series, our expectations were much higher and our wish list far more detailed than that of typical automation customers. But we knew exactly what we wanted.

Based on our detailed list of 400 requirements we defined 32 high-level criteria—affectionately referred to as “The Crown Jewels”—and our consultants came back with their recommendation about which vendors to approach. A very short list of candidates was presented. We did an extensive onsite evaluation against our requirements for each of these recommended companies, meeting with their executive management, technology officers and development teams.

**The Chosen One**

ABB was one of the companies on the short list. After numerous presentations and discussions, ABB showed us its IndustrialIT technology—the heart of its Extended Automation System 800xA—and at that point we knew that we had found the commercial solution that would take us forward. The alignment with ABB’s direction and ours meshed nicely.

We had found the commercial technology that could accomplish our goals moving forward and meet our “Crown Jewels” criteria. We could use this platform to leverage our experiences and lessons with the MOD System services and take them forward. But while the technology is a necessary ingredient to make conversations happen, much more was needed to take relationships forward.

In subsequent meetings with ABB, we mutually discovered that we had a shared vision of automation—its vision was completely compatible with our ongoing quest to practice our operating discipline. ABB was very open with us on the topic of system strategy and very willing to capture our safety control philosophy and incorporate it into its commercial offering. It also had the dedicated resources for system and technology development that we could not possibly have as manufacturer, as well as centers of excellence for safety, bench strength in systems engineering capability and the willingness to adapt its development program to accommodate our desired capabilities.

The technology vision and the ability to successfully execute and productize combined basic process control and safety in one integrated system, with the logical separation of control and safety, was of utmost importance. We did not want another proprietary solution developed exclusively for Dow. We wanted the rest of the industry to have the opportunity to benefit from what we had learned with our unique approach; therefore, we had to have a solution that ultimately would be commercially available in the marketplace.

Beyond the formal development agreement with ABB signed and announced in 2001, we forged a true collaborative relationship that consisted of four key elements: our shared vision; trust in each other; open communication; and perhaps most important after the shared vision, a willingness to confront each other.

To get things started, we laid the foundation for our collaborative relationship in a series of initial team meetings. Dow is accustomed to engaging in joint development relationships when it makes sense to do so. So when the time came to work with ABB, we had some successes on which to build a strong foundation.

First and more important than anything else, in order to proceed with this relationship, we had to have a **shared** vision.
vision. We began by doing some of the things you might expect: We developed guiding principles, defined roles and responsibilities, determined who would do what and how they would be accountable, formed teams, allocated resources and identified the risks of failure and the rewards of success. We set milestones. We understood there would be change, accepted it and set our actions and priorities accordingly.

So those are the things you might have expected us to do, right?

Working With the Unexpected

But what about the unexpected? This is how we made it happen; how we really achieved a true shared vision, one that set our relationship apart. True partnership has its roots in a true shared vision, and we worked for months to be clear about our shared values. We knew we needed to move from a traditional customer/supplier relationship—with limited interaction and major focus on price—to one embracing true collaboration.

So during our first meetings, we went around the room and asked each person to describe his or her vision for the project. But we didn’t just ask people to describe their visions—we asked them to DRAW their vision. After we drew, we talked about our drawings. We gained a lot from this exercise, and it was critical in getting us all on the same page and ensuring that our visions were aligned.

It also allowed us to begin to practice the kind of dialog we needed to have in order to create a balanced relationship involving analysis, feedback, evaluation and problem solving.

In our work on building a shared vision, we also began to address the second element—trust. Building a basis for trust and continuing to work on it is essential. We did this by simply getting to know each other.

Third, we understood the importance of communication. ABB and Dow realized early the need to engage each other regularly, so much so, in fact, that we included a clause in our contract that required regular meetings.

Think about that for a moment—a clause in the contract that forced us to interact. That single action told members of our team that communication is so inherently important that the deal would fall apart if we failed to communicate with one another.

We also had to make sure we were communicating with other stakeholders inside ABB and Dow. We had to work within each of our organizations to maintain alignment and focus on our shared vision.

Now, with all this open and honest communication, there were bound to be differences of opinion. We did have some challenges along the way; which brings us to the fourth element—a willingness to confront each other.

In some of the early implementation projects, the technical and engineering teams worked so closely together that sometimes it was difficult to tell who belonged to Dow, and who belonged to ABB unless you happened to know the people.

Conflict Management

In any relationship, confrontation, conflict management and resolution are hard work many people would rather not do; in fact, they may avoid it at all costs. There are two keys to working through conflict; the first is to begin with your own issues. The second key is to embrace the conflict. Not only is conflict inevitable, it is also necessary. It provides the energy that fuels creative solutions—but only if you let it. Unattended, conflict creates a huge drain on energy, and ultimately, sustainability; but, when approached and treated as “learning,” conflict can spark ideas and generate value!

You can do all the team-building you want or can stand, but collaboration is really about bringing together different points of view, working together to confront each other so that action and change take place. Our teams successfully did this.
Frank Duggan, senior vice president, group account management at ABB, says, “It is clear that both sides badly needed and wanted this relationship to work. This gave us a good starting point. I believe the people from both sides who were key and critical in the early incubation period of the relationship quickly got to appreciate and like one another. We employed some good tactics as a joint leadership team to engage people deep down in both organizations.”

**Mutual Respect**
This successful collaboration required tremendous organizational commitment from all parties. In addition to our strategic alignment, we found that both of our organizations had similar cultures that fostered the mutual respect for each other and trust that must happen before you can truly collaborate. That culture of respect and trust was pervasive throughout the organizations, from the executive level management to the development teams to the field engineers.

“From the outset, there has always been a culture of transparency and honesty between us,” Duggan recalls. “This has been significant in getting the relationship to succeed. This will always give a strong platform for future positive results. As in all relationships, you cannot take things for granted. You have to continue to work at them.”

This culture of mutual respect and collaboration is ingrained within and throughout our respective organizations. Even in some of the early implementation projects, our technical and engineering teams worked so closely together that sometimes it was difficult to tell who belonged to Dow, and who belonged to ABB, unless you happened to know the people from previous meetings. The synergy was that great. It made for as good a transition as one could hope for when handing over the reigns of a project you’ve nurtured for close to a lifetime.

That’s not to say that there weren’t growing pains, conflicts and disagreements along the way. That happens in any close, collaborative relationship. We did have some delays and missed milestones, as all projects invariably do. We had differences of opinion. But we used these experiences and the conflict as learning experiences, which ultimately strengthened our working relationship and our deliverable.

Now that we had found the right commercial solution and supplier relationship to take our operating discipline forward, we had to see what kind of results it would deliver throughout Dow’s plants worldwide.

We had said that MOD 5 would be a tough act to follow…could ABB provide a worthy successor? The next article in this series will discuss the results and future direction of this collaboration.

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MAKING IT WORK: The Dow/ABB Collaboration

Lessons learned from years-long collaboration benefit ABB, Dow and the rest of the process industry.

By Margaret Walker, Ed Sederluna, Jerry Gipson and Eric Cosman, The Dow Chemical Company

Innovation has always been at the heart of The Dow Chemical Company (Dow), Midland, Mich., and today it is the essence of its stated mission “to constantly improve what is essential to human progress by mastering science and technology.” To achieve this mission, we are committed to the principles of sustainable development and to achieving the triple bottom line of economic, social and environmental progress. These principles form the basis of our philosophy and approach to process automation.

For more than 100 years, Dow has been striving for true “operational excellence,” long before the term was coined by industry analysts. Over the past 30 years alone, we have evolved a standardized, redeployable process control strategy that supported our goals of overall consistency, productivity improvements, global operating discipline and innovation—all while maintaining high safety performance.

Indeed, consistency and sustainability are the foundation of that strategy. As a global company, it’s important to operate facilities in the same way every single day to achieve consistently high quality, process reliability and repeatability of best practices. Consistency and sustainability are paramount to global competitive advantage, enabling us to drive down costs while earning us the right to grow.
In the first article in this series, “The MOD Squad: Process Automation at Dow,” (1 www.controlglobal.com/articles/2006/029.html), we described how our process control strategy led to the development of a series of proprietary process control systems, culminating in the MOD 5. That system—still in use today—has several capabilities that are not commonly available in many commercial systems. Each of these capabilities was developed in direct response to a specific business need. As a result, the application of this system has resulted in tremendous productivity benefits.

However, in early 2000, due to the speed of changing technology, we realized it would not be cost-effective to continue to invest in proprietary hardware and software systems. We needed to focus on our core manufacturing business without losing the advantages that we had gained.

After a detailed analysis of the capabilities of the MOD system, we defined a set of high-level criteria that we consider essential to any commercial process automation system. This process was described in the second article in this series, “Process Automation at Dow: Part 2” (2 www.controlglobal.com/articles/2006/098.html). Each criterion corresponds to a specific value that we have achieved with our proprietary MOD system.

Reduced Downtime Through Automation

One criterion for process automation is directly related to increasing process availability. According to a November 2006, report from ARC Advisory Group, about five percent of production in the process industries—valued at $20 billion a year in revenues—is lost to unscheduled downtime. Most of this, says ARC, could be readily avoided through improved automation capabilities.

As part of an ongoing collaboration with Dow, industrial automation system vendor ABB (www.abb.com) recently introduced the “Load-Evaluate-Go” feature for its industrial IT System 800xA. The newest version of System 800xA includes new engineering functions that enable one to make changes to a copy of the running program, and then load that copy into the running production system with the old version of the program. This, in turn, makes it possible to evaluate the impact that such changes would have on the production process by examining the differences between the “old running program” and the intended “new program.” It is then possible to choose to commit to the new program or back out of it with the old program still running, make necessary changes, and go through the process again. This capability provides two key benefits. First, it significantly reduces the risks associated with making application changes in the running process. Second, it improves overall efficiency by avoiding production stops, missed or delayed product deliveries, and costly downtime.

Load-Evaluate-Go complements other elements of System 800xA, including the innovative System 800xA High Integrity combined control and safety option. With embedded safety and control within the same flexible architecture, it is possible to combine control and safety functions within the same controller, or to keep control and safety functions separate within the same system. This improves process availability while reducing risk to overall plant operation by providing a common high-integrity system environment for production control, safety supervision and production monitoring.

A Collaborative Foundation

Well before any real collaborative development took place, however, the foundation for a true collaborative relationship needed to be established. The beginning of this process was described in the third article in this series, “Collaborative Process Control: The Dow/ABB Story” (3 www.controlglobal.com/articles/2006/216.html.) Over time, Dow and ABB have forged a relationship that nurtures ongoing development activities. This relationship consists of four key elements of collaboration:

• Shared vision
• Trust in each other
• Open communication
• And perhaps most important, a willingness to confront each other and use conflict constructively.

With this foundation in place, it was possible for both teams (Dow and ABB) to work closely together to build a strong collaborative relationship that transcended all levels of our mutual organizations and provided the innovative environment needed to develop successful solutions.

The Elements of Collaboration

In working with ABB, Dow quickly discovered that we shared the first element of collaboration: a shared vision. ABB’s vision of automation was completely compatible with ours. ABB staff have been very open with us on the topic of system strategy and willing to capture our safety control philosophy and incorporate it into its commercial offering. ABB also had the dedicated resources for ongoing system and technology development that we could not possibly have as a manufacturer, as well as centers of excellence for safety and bench strength in systems engineering. Furthermore, ABB showed a willingness to adapt its development program to accommodate our desired capabilities.

Our vision for automation remains that of using a commercial system that meets all of the criteria for operating...
discipline. At the same time, this system must be successful in the marketplace to keep it cost-effective and to enable the rest of the industry to benefit from Dow’s leadership in automation. We did not want another proprietary solution developed exclusively for Dow. We wanted the rest of the industry to have the opportunity to benefit from what we had learned with our unique approach.

The second element of collaboration is trust. Our collaborative relationship has required tremendous organizational commitment from all parties. As we worked together, we found that both of our organizations had very similar cultures that fostered mutual respect for each other, leading to shared trust. That respect and trust was pervasive throughout the organizations, from the executive level management to the development teams to the field engineers.

Even in some of the early implementation projects, our technical and engineering teams worked so closely together that when one encountered a group of them, it was difficult to tell who belonged to Dow, and who belonged to ABB.

Open communication is an essential element of collaboration. Team members from Dow and ABB make every effort to stay in touch with each other on a continuous basis and have organized working groups to maintain a good rapport through a combination of electronic media and face-to-face meetings. Each party to such a collaborative effort must have the mindset that it is part of the same whole, so that collectively, we are all part of the same team.

While you can do all the team building you want, collaboration is really about bringing together diverse perspectives, because this is really what stimulates creativity and out-of-the-box thinking. As mentioned, this requires an environment of trust and open communication to not only express one’s opinions, but also to debate and discuss openly and agree upon potential solutions. A mutual focus on the details and continuous measures of forward progress are also essential to stay on plan. This is how constructive and successful change takes place.

To summarize, the key elements of any successful relationship include a shared vision, trust, communication and the willingness to confront each other. All are critical components of the joint development process.

In the classical customer/vendor relationship, the vendor asks “what do you need?” and then goes away, reappearing later to present “the answer.” We, however, chose a different, side-by-side parallel approach that has ultimately delivered against our goal.

The Dow and ABB relationship has become stronger with the passage of time. When we began, each company had its own view of the world of automation. These visions were compatible, but different in some respects. Dow’s MOD 5 FORTRAN-like language and ABB’s object-oriented programming appeared to be on a collision course, with two different automation suppliers’ philosophies. This collision, however, began the long process of actually integrating the ABB System 800xA product into Dow as the preferred and standardized automation platform. Trust and collaboration evolved as each company learned more of the capabilities of the other, and thus began the process of listening and acknowledging the possibilities of the others’ ideas. Today our relationship is much more than supplier and customer, and we strongly believe that our working relationship will continue to generate enhanced value for Dow and ABB, for industry and for the marketplace.

Closing Thoughts
As the collaborative development relationship between Dow and ABB continues to grow, the process industries stand to benefit from the commercial availability of even more capabilities that support Dow’s operating discipline. In our ongoing quest to share its innovative approach and best practices for the greater good of the entire industry, Dow has collaborated with ABB to transform key elements of our operating discipline into commercial product features. We will continue to make these widely available so process manufacturers can operate their own facilities more safely and productively. This innovative relationship and collaborative business and development effort provides a win-win-win scenario for Dow, ABB and customers in all process industries.

Margaret Walker, Ed Sederlund, Jerry Gipson and Eric Cosman are Dow employees.
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