



COMPRESSED GAS ASSOCIATION

Founded in 1913, the Compressed Gas Association ([CGA](#)) is dedicated to the development and promotion of safety standards and safe practices in the industrial, medical, and food gases industry. Their mission is to promote ever-improving safe, secure and environmentally responsible manufacture, transportation, storage, transfilling and disposal of industrial, medical, and food gases and their containers.

To better serve their end-users and industry partners—regulators, code developers, and international standards bodies—and support future growth, CGA modernized their association management system. In addition to governing internal workflows, this system provides an e-commerce store where members and customers can purchase CGA safety publications. The store accounts for 75% of CGA's non-dues revenue, making its usability and stability crucial for CGA, its members, and its customers.

THE NEED FOR A FLEXIBLE, MODERNIZED SYSTEM

CGA’s association management system was built upon on two different web applications, four Microsoft (MS) Access databases, and hundreds of reports.

The complexity of the system and the difficulty posed by maintaining it prevented growth and created several challenges:

- Customers struggled to navigate the outdated user interface, often encountered data-driven errors, and were frustrated by the site’s limited feature set
- Staff were required to navigate complex workflows involving six different administrative interfaces to maintain the system, reducing their efficiency and increasing the probability of error
- Data entry was manual and repetitive. The architecture of the system required the same information to be entered in different underlying systems through duplicative interfaces. If this was not done consistently, data errors made it impossible to retrieve reliable, accurate information
- Some of the underlying software packages were no longer supported by the manufacturer
- CGA found it extremely difficult to incorporate new features into the system. Attempts frequently led to unanticipated problems and reduced the system’s reliability

CGA chose to partner with ExelARATION to address these challenges and modernize their association management system. The objective was to create a new and better system that would support more product offerings, increase customer satisfaction, and be easier to maintain. ExelARATION coupled their extensive Agile software development and DevOps knowledge with industry best practices to modernize CGA’s legacy system and deliver on their objective.

THE SOLUTION

ExelARATION began by introducing a modern architectural design. To create more stability, reliability, and maintainability, the underlying business logic was separated from the user interface (UI) and rewritten in C#. The dramatic impact of this shift was captured through SilverThread code analysis.

By segmenting the architecture, ExelARATION was able to create a comprehensive unit test suite that validated the business logic’s functionality. Using a DevOps mindset, ExelARATION created a build and deployment process that integrated this test suite with an automated process of deploying all changes—new features and defect fixes—to the production environment. If any tests failed, the build and deployment would also fail, ensuring any preventable defects did not reach production.

THE RESULT

Together, these changes introduced by ExelARATION reduced application maintenance costs by 83%. CGA invested the time and effort saved in maintenance and defect fixes into new feature development that benefitted from the automated build and deployment process.

Reduction in Code Complexity

	Visual Basic Code	New C# Code	Comparable Benchmarks
File Connections (lower % indicates more dependencies)	18%	96%	80%
Modularity (lower % indicates tighter coupling)	9%	100%	99%
Clusters of Large Cycles (lower % indicates greater complexity)	5%	100%	92%

Improvement in Maintainability

	Visual Basic Code	New C# Code
Overall System Maintainability	27%	99%
Defect Ratio (% of defects introduced per KLOC)	9%	4%
Downstream Risk	7.2%	2.5%

THE SOLUTION

With a solid architecture and automated build process in place, ExelARATION moved on to improve the usability of the system for the benefit of all users, including CGA staff, members, committees, and customers. ExelARATION took the following steps:

- Analyzed the functional and technical architecture of the system to identify effective modernization strategies
- Collected data about the user experience (UX) through interviews and observations, evaluated the UI, and researched options for improved approaches
- Created options for replacing the customer-facing website. Presented these options and their respective tradeoffs to CGA so that they could make an informed, data-driven decision on a way forward
- Ported all MS Access features into a web-based user interface and combined existing “web portals” into a single, consistent UI, thereby streamlining user workflows and eliminating redundant data entry
- Established referential integrity within the underlying database to eliminate the need for duplicative data entry and reduce data-related errors

THE RESULT

Through these steps, ExelARATION reduced the number of administrative interfaces from six down to one. This dramatically improved the usability of the system. Data entry errors were eliminated by rearchitecting the underlying database—normalizing it, removing

duplicates and establishing referential integrity. This work made it much easier to enter data into, retrieve data from, and effectively use the system, both for CGA staff and their end-users.

ExelARATION’s investigation also revealed unnecessary payment processing expenses; CGA was able to reduce the cost of payment processing by 50% while simultaneously simplifying the purchasing processes for members, committees, and customers.

THE SOLUTION

A key objective for CGA was the ability to deliver new features effectively, without compromising system reliability. ExelARATION’s architecture and DevOps infrastructure provided the foundation for a new approach. Using Agile software processes, ExelARATION demonstrated how work could be prioritized by value and impact, delivered in small batches, and continuously improved. Agile uses multiple, integrated, rapid feedback loops to ensure that the most valuable changes are being delivered consistently and that customers—CGA staff and their end-users—are benefitting from those deliveries.

Throughout the process, CGA regularly reviewed plans for upcoming work and reprioritized it based on new information, emerging opportunities, and shifting priorities. Through collaborating with ExelARATION, CGA learned how Agile’s rapid feedback loops can create a culture of trust that leads to high quality and rapid execution against organizational priorities.

THE RESULT

By using Agile, ExelARATION greatly increased visibility into the ongoing work, enhanced CGA’s prioritization decisions, improved the effectiveness of the team, and reduced the time spent on defect fixes.

Accelerated Feature Development

	Visual Basic Code	New C# Code	Comparable Benchmarks
Days per KLOC	16	14	N/A
% Effort (Feature Development)	75%	86%	84%
% Effort (Defect Fixes)	25%	14%	16%

CONCLUSION

CGA's decision to partner with Exelation to modernize their association management system resulted in a series of important benefits.

By combining early career professionals with experienced senior architects, Exelation delivered high-quality solutions at less expense

- By using modern architectural designs, Exelation was able to develop a new, streamlined UI, comprehensive business logic, and normalized database that improved usability, eliminated tedious and redundant workflows, and reduced errors

- By using Agile software development practices, Exelation improved the efficiency of development work and accelerated the delivery of new features without compromising system stability
- By increasing the reliability of the system, CGA saw an 83% reduction in application maintenance cost

CGA's staff, customers, and members have a new, simplified user interface that provides a richer user experience, more efficient workflows, and fewer defects. The modernized system provides a significant reduction in maintenance costs while simultaneously providing more rapid delivery of changes and improvements, all without any compromise to product quality.



CGA has been working with Exelation since 2014 to modernize the legacy databases and web-based applications that make up our proprietary association management system.

Throughout our project, we have worked with a combination of senior developers and students from the Exelation Center in Blacksburg, Virginia. This approach resulted in a substantial cost savings for CGA without any compromise to product quality or timeliness; in fact, the students have been the catalysts for some significant value-added innovations on our project. The senior developers have consistently delivered high quality technical solutions, demonstrated the ability to adapt to our shifting needs, and have been mindful of the project budget. Everyone who we have worked with at Exelation has been extremely professional and able to communicate easily with all members of our staff, regardless of their level of technical knowledge related to our systems. We would absolutely recommend Exelation to anyone considering their services.

—Laura Brumsey, CGA acting Product Owner and VP of operations

About Exelation

At Exelation, we build world-class software. We also build world-class software developers. Started in 2008 as an experiment to see if full-time college students can jumpstart their tech careers before graduating, Exelation has proven that experiential learning is essential to developing a productive workforce. Students at our award-winning Exelation Center at Virginia Tech in Blacksburg, VA, deliver state-of-the-art software under the guidance of veteran developers, saving our clients time and money.

Learn more at www.exelation.com.

