An AI-EMPOWERED Workforce

More than 3,200 Laboratory employees participated in aiEDGE (AI education for development, growth, and excellence) Innovation Day in 2025.

AI technologies have permeated countless aspects of everyday life, with large language models (LLMs) among the most recognizable advances. Trained on huge collections of textual data, LLMs predict what comes next in a sequence, which makes them useful for explaining concepts and summarizing information. For example, the LLM behind a customer-service chatbot can answer probable questions by combining a general-purpose language model with scripted replies based on the company's policies.

Livermore researchers have long been exploring AI technologies and integrating them into scientific applications from nuclear nonproliferation and medical countermeasures to fusion experiments and manufacturing processes. (See *S&TR*, April 2021, pp. 4–11; September 2022, pp. 4–11; and September 2024, pp. 4–11.) For example, with sufficient computing power, AI tools can often analyze massive data sets more quickly than humans can. Related investigations include testing models' trustworthiness and robustness against adversarial attacks, as well as developing models to augment high-performance computing workflows.

Although intelligence is part of the terminology for these technologies, they are not "intelligent" in the same way as humans. LLMs and other AI models mimic human intelligence by recognizing patterns and predicting likely outputs—and they can be wrong. "The models give answers based on probability within patterns, and the answers may or may not be correct. People may expect accuracy a hundred percent of the time. This fallacy forces us to rethink how we approach data governance and curation to improve the probability of success," says Tony Macedo, the Laboratory's director of technology transformation. With this distinction in mind, AI offers an immense landscape of possibility for a workforce such as Lawrence Livermore's: motivated to improve and transform the activities that serve a national security mission.

The Laboratory's widespread adoption of LLMs and other AI tools has been both enthusiastic and cautious. From an operations perspective, the Laboratory has also made room for AI in business-oriented tasks big and small, such as process documentation, financial analysis, or meeting transcription. With encouragement from senior leadership, employees are welcoming the AI era with secure access to commercial LLMs, a homegrown retrieval-augmented generation (RAG) solution called LivChat, and an array of skill-building resources.

Inside the Firewall

Opening a web browser to type a query into any commercial LLM is fine for at-home use, but Laboratory-controlled workstations, laptops, and mobile devices are connected to carefully configured and monitored networks with strict cybersecurity protocols. Like other cloud services, LLM-based tools are thoroughly evaluated by Livermore's Cyber Security Program and LivIT, the organization responsible for all aspects of information technology. Considerations include data exposure and protection, vulnerability analysis and mitigation, model validity, and vendor trustworthiness. In addition, for sensitive data use, cloud service vendors must meet the Federal Risk and Authorization and Management Program's requirements before a Department of Energy (DOE) laboratory can adopt an LLM—an often lengthy process.

"The commercial AI market is moving quickly, and vendors do not have need-to-know access to our work. As the customer, we are responsible for appropriate controls and policies for our users," explains Greg Herweg, the Laboratory's chief technology officer. Accordingly, most LLMs currently available to staff are restricted to use with unclassified, publicly releasable data. LivIT has taken the extra step of deploying LLM access to the classified network via cloud services within a secure cloud environment. "Both solutions are important, and we're ensuring that nothing nefarious happens on our networks," adds Macedo.

Although bringing LLMs inside the Laboratory's firewall is extensive and complex, requesting access is easy: An employee simply opens a LivIT service ticket. Given this streamlined deployment, employees can experiment with multiple AI technologies and offer feedback directly to Herweg's team. "Most people are happy to use the range of models we manage. Some tell us they want more options and faster, and they are eager to help improve the process of vetting and onboarding a new technology," says Herweg. "We provide several models to see which ones are good matches for staff needs. In the future, we expect there won't be a single winner, and we'll continue offering multiple options."

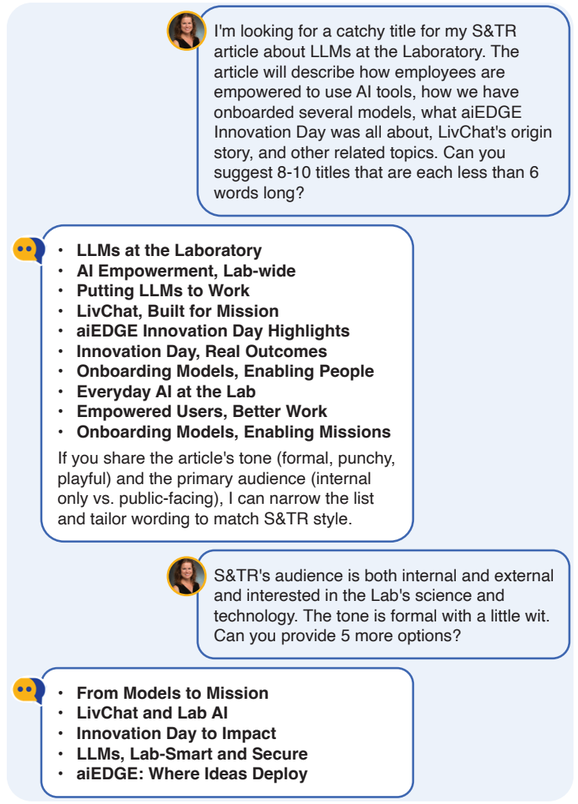
From RAG to Riches

Ryan Beall, the team lead for Livermore's enterprise search and AI services, was involved in early discussions about drawing on LLMs to improve search systems at the Laboratory. As development of a new search tool progressed, several leading commercial AI models were making their way through the approval process. These efforts soon converged. "Now we could use the frontier models instead of relying on those that were worse quality or badly maintained," states Beall. "I realized this would be a big deal and we needed to expand."

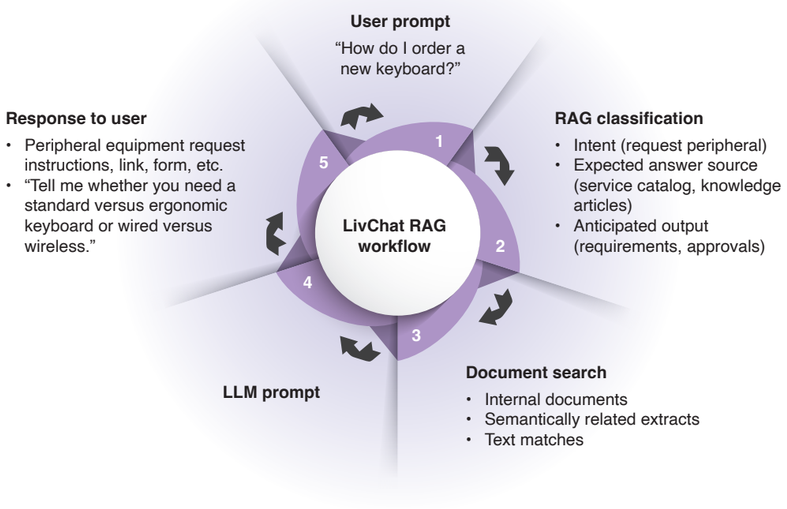
In an episode straight out of application development lore, Beall spent a weekend building a cloud-secure, LLM-integrated tool from scratch. After presenting his work to managers the following week, the project took off like a rocket. Fast forward to the summer of 2024, and LivChat was unveiled Laboratory-wide.

LivChat works via RAG, which means its LLMs are trained on general data while the retrieval system stores an index of data customized to a specific context—in this case, the approved internal resources. RAG systems are less prone to hallucinations (plausible but incorrect answers) because they draw on authoritative context, and the index can be updated easily without retraining the model. These qualities make RAG systems ideal for internal content.

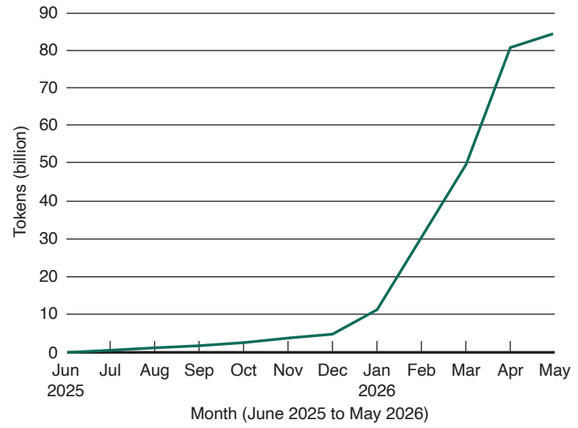
"We decided from the start to make LivChat as easy as possible for people to transition into usage. In my 20 years as a developer, feedback is almost always negative, but users are incredibly positive about LivChat," says Beall. Patrick Meissner,



This article's author used LivChat, the Laboratory's custom large language model (LLM)–integrated chatbot, to brainstorm titles. Additional prompting could have refined the results to suit the article's broader scope. A separate interaction with LivChat inspired the "From RAG to Riches" section heading, showcasing the tool's utility for ideation.



A user asking LivChat a question initiates the retrieval-augmented generation (RAG) system to classify the request. After a document search, LivChat prompts the user-selected LLM with the retrieved information and returns an answer.



The Laboratory's LLM usage has skyrocketed in 2026, as measured by the number of tokens used. An LLM breaks text into tokens, or chunks, that are mapped to the model's numerical computations. Tokens provide a useful way to measure consumption because counting individual users may not capture the full demand on LivIT's LLM services.

who serves as deputy program leader for LivIT workforce enablement, agrees, "I hear a lot of success stories about how LivChat speeds up somebody's workflow or helps them find an answer."

Averaging thousands of users per month, LivChat will continue to provide value as Livermore's workforce evolves. "About half of the Laboratory's staff has been here less than 10 years," states Meissner. "One person said that using LivChat was like having a longtime employee by their side. With LivChat, new employees can find answers to common institutional questions quickly and efficiently without needing to involve senior team members."

All Hands on Deck

Providing access to LLMs without any guidance is similar to giving someone the keys to an unfamiliar car without driving lessons. The Laboratory takes a multipronged approach to employee upskilling with an information hub known as aiEDGE (AI education for development, growth, and excellence). The aiEDGE website houses educational resources, details for requesting access to LLMs, a schedule of upcoming training and speaker events, and more. Industry partners are invited to many of these training sessions. "Having the vendors' field engineers attend the sessions has been a real asset. We tell people to bring their problems, and we'll work on them together," says Macedo. Herweg adds, "The Laboratory is leaning into relationships with industry, which is generally outpacing us with AI investments. We can help improve their models with feedback about scientific domains and data they don't have access to, although evolving reciprocity requires close attention." Additionally, AI Town Hall meetings highlight research projects and industry-related activities both at Livermore and in the broader U.S. landscape. For scientists and engineers, the SEAM (Shared Education in Artificial intelligence and Machine learning) program offers professional development courses led by fellow researchers.

Besides asynchronous and on-demand opportunities, the Laboratory also organized a dedicated AI training day last year. More than 3,200 employees participated in aiEDGE Innovation Day's live demonstrations and hands-on workshops. Herweg notes, "Face-to-face communication is good when dealing with the complex nuances of AI technologies. An event such as this one creates a body of like-minded people who may be meeting each other for the first time."

The day kicked off with a message from Laboratory Director Kimberly Budil, who advised, "We don't know what the full implementation or possibility is for tools that are developing in real time, but we're Livermore. [We] think different and think big." After keynote talks from two industry partners, employees split off into breakout sessions led by trained colleagues. Topics ranged from AI-augmented programming, data mining, and experimental design to tips for using AI tools in research writing, work controls, and business use cases.

An Explorer's Mindset

In her aiEDGE Innovation Day message to all employees, Budil urged, "I want you to adopt an explorer's mindset. See where these tools will take you and see what the possibilities are." AI is already transforming work at the Laboratory—not by replacing people but by augmenting their work. Staff are creating efficiencies and investigating new ways of approaching problems, as well as sharing insights with other laboratories. For example, Meissner says, "Ryan (Beall) has been demonstrating LivChat to other laboratories, getting them interested in the technology, and explaining how they could develop a similar tool." Livermore researchers are also developing AI agents, which can assist with iterative tasks and decision making, for integration into scientific workflows.

In a Laboratory-wide survey conducted earlier this year, 68 percent of respondents reported using AI tools daily or weekly, with coding assistance noted among the top use cases. One of those users is Lindsey Whitehurst, a software engineer in Livermore Computing and Global Security Principal Directorate programs. "When starting a new project, I can use an AI assistant to help me understand the architecture. Coming up to speed with an assistant is quicker and easier than manually working through the project's structure," she explains. With LLM-based coding tools deployed by LivIT, Whitehurst can plan how to integrate a new feature into an existing code base, implement that plan, and check the integrity of her newly generated code. She adds, "These tools help me review code more efficiently by summarizing changes, flagging potential concerns, and giving me another perspective as I evaluate the implementation."

Whitehurst describes her experience with LLMs as "skeptical optimism," noting that some tasks that used to take multiple days

The aiEDGE Innovation Day event complemented the Laboratory's other AI training activities. Employees chose among scientific- and business-focused educational sessions. (Photo by Blaise Douros.)

can now be completed in an afternoon. Productivity gains are just one upside. She states, "I have been impressed with the quality of the output from these tools. However, I still think having a human in the loop who understands the code and can thoroughly review the output is critical."

Transformation begets collaboration, and in February 2025, Livermore joined other national laboratories for the DOE's 1,000 Scientist AI Jam Session, which focused on using advanced AI models for scientific problems. Earlier this year, the DOE announced the Genesis Mission to accelerate science and strengthen U.S. competitiveness with AI. Livermore brings several strengths to this initiative including deep expertise with industry partnerships, unique data sets, advanced computing resources, complex scientific problems—and now a workforce empowered by AI technologies.

—Holly Auten

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