Pervasive Intelligence

Advanced Technology Laboratories’ influence can be found in many Lockheed Martin products

As an example of a business that has forged multiple collaborative links across varied Lockheed Martin businesses, it’s hard to beat Lockheed Martin Advanced Technology Laboratories (ATL). The Cherry Hill, N.J.-based enterprise of six laboratories is involved in activities that support all of the Corporation’s business areas as well as corporate-level initiatives.

Once noted for its work in commercial sound and optics technologies, ATL today has evolved into an advanced and applied computing research center, specializing in the fields of artificial intelligence, human cognition, brain-inspired computing, robotic autonomy, collaboration technologies, advanced software development tools, distributed systems and real-time systems.

“Our business model consists primarily of competing for programs run by DARPA (Defense Advanced Research Projects Agency) and by the (U.S. military) service laboratories,” says Jim Marsh, ATL’s director. “Our engineers perform testing on a mapping handheld device. Working with the customer testing geolocation of radio frequency emitters are ATL engineers, from left, Albert Davis, Paul Tilghman and Jay Byron.

Lockheed Martin Advanced Technology Laboratories engineers perform testing on a mapping handheld device. From left are Matt Weimer and Tim Souder.

second biggest source of revenue is through contracts with other Lockheed Martin business units.”

While ATL is part of the Electronic Systems Business Area — and companies in this area represent the largest portion of ATL’s Lockheed Martin program work — it also contracts routinely with units in other business areas.

ATL’s support of Lockheed Martin’s diverse lines of business occurs in many ways. Even on programs for which it contracts directly with DARPA and the service labs, ATL’s purpose is to acquire expertise that can be transitioned and applied to other areas of the Corporation.

“Ultimately, the technologies we develop on DARPA programs find their way into Lockheed Martin products and programs,” Marsh says. “DARPA and the service labs are the technology leaders for the Department of Defense. If you follow them, you are pretty assured that at some point it will tie into a Lockheed Martin program.

“We try to develop technology that the rest of the Corporation doesn’t even know it needs yet.”

By competing in the recent DARPA Urban Challenge for autonomous vehicles, for example, ATL gained expertise in designing autonomous decision-making systems, which eventually could help several Lockheed Martin programs.

“(See LM Today, Nov/Dec 2007.) Another example of technology developed by ATL that will transition to a business unit is the Coalition Joint Spectrum Management and Planning Tool. Under contract to the U.S. Army Communications-Electronics Research and Development Engineering Center, ATL has delivered a system that optimizes use of the crowded wireless spectrum, making it easier for troops to communicate while avoiding interference from jamming and blockage by competing signals.

The tool is already being used in Iraq, Marsh reports. Ultimately, the program contract for the tool will reside with the Information Systems & Global Services Business Area.

ATL’s work with other Lockheed Martin business units follows a variety of models, and often ATL serves as the central point for connecting business units to new technology systems.

For example, it is working under contract to Lockheed Martin Missiles and Fire Control on a system that integrates multiple sensors across many platforms and networks. The “smart” technology solution allows systems to automatically discover resources and services when they plug into the architecture. As the technology is developed further, ATL will approach other Lockheed Martin business units with products that could benefit from it.

Sometimes, ATL works simultaneously with business units and corporate departments. It is collaborating with Information Systems & Global Services on the Software Technology Initiative, which also has corporate-wide application that is managed through the Corporate Engineering and Technology office.

The Software Technology Initiative, Marsh explains, is designed to address “wicked systems,” those that are so complex that computer participation in systems design could dramatically lower cost and cycle time.

“We’re talking about systems with tens of millions of lines of code, portions of which are coming from many different places,” Marsh says. “It’s very difficult for a human being to grasp all of the design implications and spot the potential flaws in combining those pieces.”

But by developing modeling and trouble-shooting technologies, the Software Technology Initiative is helping in the development of large, reliable, integrated systems in about one fifth the time and at about one fifth the cost of current production methods.

Yet another ATL development model is its collaboration with university research programs. One initiative using this approach is the development of software that “learns” in a way similar to human learning, Marsh says. Nine universities are participating in the research, which could save software developers having to program every action. Instead, software systems will be able to learn on their own what needs to be done.

There are dozens more examples of how ATL is exploring technology that can be applied across multiple Lockheed Martin programs and lines of business, and Marsh says they all support the same vision — to effectively transition new technologies from the laboratory to customer solutions.

“We coalesce and transition innovation and domain expertise into operational applications,” Marsh says. “We do that in many different ways for many different customers, with some of the best science and technology minds in the world.”


Lockheed Martin Advanced Technology Laboratories

Advanced Technology Laboratories Develop Customer Solutions

Lockheed Martin Advanced Technology Laboratories consists of six laboratories. The most recently added is the ISX Laboratory, which was formed when Lockheed Martin acquired ISX Corporation in 2006.

• **Advanced Concepts Laboratory** — Defines, researches and develops basic and applied solutions with a strong emphasis on demonstrable prototypes that lead to the early deployment of new technology. This lab includes classified programs, which represent one of ATL’s fastest-growing business areas.

• **Artificial Intelligence Laboratory** — Develops and applies artificial intelligence technology to distributed, real-time and autonomous systems for military platforms. The laboratory’s ability to embed artificial intelligence systems into larger software systems allows human decision-makers to increase efficiency and deal with complex, time-sensitive environments.

• **Distributed Systems Laboratory** — Creates innovative, distributed, highly flexible, secure and trusted infrastructures for next-generation command, control, communication, computer and intelligence systems. The lab applies domain-specific information, transforming technology into scalable and evolving frameworks, and enhancing the performance and capability requirements of decision-driven systems.

• **Embedded Processing Laboratory** — Researches and develops embedded technologies and complex systems. These efforts are applied to secure, reliable network issues; to improving wireless communications through digital radios and dynamic allocation of spectrum; and to advanced modeling and simulation.

• **Contextual Systems Laboratory** — Develops system interfaces to be more intuitive, natural and cognitively capable of interacting with human decision-makers. Adaptive interfaces improve readiness and operational capabilities by monitoring the physiological states of human operators and adapting to maximize their output in stressful and varied situations.

• **ISX Laboratory** — Focuses on the best of emerging information and knowledge systems technologies to high-value operational problems. The lab focuses on decision superiority, knowledge management, network-enabled command and unmanned airborne systems.