Microsoft

# Best of Business AI
# Bell case study

Bell is reimagining the experience of flight. Headquartered in Fort Worth, Texas, the company has over 85 years of experience manufacturing helicopters and it is leveraging that knowledge to venture into unmanned autonomous vehicles. Bell prides itself on not just producing best-in-class aircrafts but being a leader in the industry.

Bell is dedicated to constantly modernizing its technology and staying on the cutting edge of innovation. It's only natural that in pursuit of continuous improvement, Bell began to explore the use of artificial intelligence (AI). The AI solutions Bell is developing today could one day fly on aircraft as part of an AI-powered autonomous fleet that can be used to move people, cargo, and data.

"Bell's Innovation team is focused on exploring 'what-if' scenarios, evaluating new capabilities, and safely developing innovative technology it's released to mainstream users," says Jason Hurst, the Vice President of Innovation.

Even for a company dedicated to advanced technology, adopting AI requires careful planning. With a thoughtful approach, Bell is successfully incorporating game-changing AI capabilities in the very heart—or brain—of their aviation technology.

## Bell structured their organization to ensure the successful adoption and rollout of AI

### A dedicated innovation team

To make all of these ambitions possible, Bell established a team dedicated entirely to their innovative products. According to Grant Bristow, Innovation Technical Lead, the Innovation team works almost like a startup. While they have a license to experiment and test the boundaries of technology, they need to ultimately advance the company's overall portfolio.

*Scale*

### Demonstrating incremental progress

While pursuing an AI project, the innovation team takes an incremental approach, where they need to demonstrate progress every few months. For example, to demonstrate the capabilities of unmanned aircraft, they applied the same AI tools to power fully autonomous five-pound drones, which were shown off at the 2020 Consumer Electronics Show (CES) convention.

*Strategy*

Sharing proofs of concept (POCs) regularly has helped ensure buy-in from Bell leadership. As Matt Holvey, Senior Manager of Intelligent Systems, says "Highly iterative, incremental proofs of concept—demonstrating something every three to six months—are the best way to gain and continue the championship and endorsements from upper leadership."

### Leveraging employee expertise

When developing AI-based systems, it's critical for Bell to mine their employees' aerospace expertise. Training an AI model involves a lot of decisions that shape how it works and what its goals are – so engineers need to be involved as much as data scientists.

*Culture*

"Any digital transformation is going to require creating a bridge between that tribal knowledge and what we might call the 'untrained tools' (the raw AI algorithms)" says Holvey.

“We want our AI tools to contain the knowledge that we've spent so many decades building up as a best-in-class aerospace industry.

**Getting employees on board**

When it comes to AI projects that affect engineering processes, it’s important for Bell to keep engineers informed. They make sure the engineers understand the AI application, and make it clear that the purpose is to complement their work and offload more menial tasks so they can focus on applying their expertise.

*Culture*

Holvey says "A successful path is to say ‘I am bringing AI tools that can augment the brilliant work you are already doing today and maybe offload some of the boring and dirty work that keeps you from truly focusing on the creative hard stuff.’"

Additionally, achieving buy in from engineers is similar to achieving buy in from leadership: the best way to win support is to actually demonstrate how AI works on an everyday basis.

**AI oversight and improvement**

Bell is well-aware that once the AI models are up and running, their job is not over. It’s important to continually maintain and improve the models over time. Bristow says, “A lot of people get fixated on the training. That is a challenge, but it's half the battle. Once you have the models, how are you going to manage them? How are you going to ensure that they cohesively integrate into your workflow? And then, how do you maintain them? How do you plan to improve it? Because ultimately, if you don't have a refinement strategy for your AI, a couple of years from now you could find yourself back in the same boat.”

*Scale*

**Safety, transparency, and accountability**

For Bell, it’s of the utmost importance that they introduce next-generation technologies in a safe manner. The idea of a self-driving car is hard to get used to—an unmanned aircraft is even more revolutionary. To ensure safe and responsible AI technology, Bell is starting out developing unmanned cargo vehicles and will advance incrementally to carrying people.

*Responsibility*

Regulation is the most significant hurdle for the use of AI in aviation. Aircraft certification requires transparency and accountability for every single component that helps the aircraft fly. AI-based systems are no exception.

Holvey says, “There will always need to be some level of human accountability really every step of the way.” Bell is working towards “certifiable AI,” but it will be a long journey to get there. It the meantime, they need to make sure the AI models they are using are not “black boxes” that cannot be audited and troubleshooted.

## AI in action: AI-powered flight

Bell is leveraging Microsoft AI technology that enables an aircraft to takeoff, fly, and land independently. Unlike traditional rules-based technology, the AI-based system can adapt to changing variables. Imagine an assembly line with robotic arms. Typically, the arm would have to pause if a part wasn’t oriented correctly on the production line. But with an AI model added to the controls, the arm can adjust its movement to install the part no matter how it’s positioned. This same concept applies to aircraft. “Autopilot” capabilities that are common today are rules-based. AI-powered flight is revolutionary.

Training the AI model is tricky. Take landing, for example. A body of water might appear to be a solid surface. From a few hundred feet up, a field of wheat may look like a safe flat landing zone. However, if the AI doesn't realize that the top of wheat isn't firm ground, it may execute a landing maneuver several feet too early.

Bell used a Microsoft platform for training the AI with reinforcement learning—in which AI learns by executing decisions and receiving rewards for actions that get it closer to an end goal. Letting the AI fail over and over again as it slowly learns would be impossibly expensive and dangerous in the real world, so the learning takes place in simulated environments. Simulated environments can replicate millions of different real-world scenarios that a system might encounter, which also makes it much faster than real-world training. The AI models trained by Bell can practice thousands of simulated landings in minutes.

Hurst says, "Microsoft has had their flight simulator out there for decades now. The recent enhancements have added a significant amount of realism to them. We're partnering our early AI tools with the flight sim environment."

Even for piloted flights, there's a lot of potential for AI to augment the data that's fed to the pilot. There is a high rate of incidents in the rotorcraft world related to a loss of situational awareness. This might happen when a pilot inadvertently enters into difficult weather conditions that they didn't plan for. AI can potentially recognize and anticipate those issues, feeding data and information to the pilot to add an additional level of safety on the aircraft.

"There's definitely a shift towards more training in the simulated world and less training in the real world, where you're using up time on the aircraft and incurring maintenance cost and fuel costs. That's a much more expensive way to conduct training," says Hurst.

In their engineering and manufacturing processes, AI is helping unlock the industry knowledge and expertise that Bell employees are known for. By automating heavy post-processing activities such as computational fluid dynamics (CFD) analysis and aircraft design optimization, Bell can explore more designs faster and earlier in the process. Helping these teams work faster and more accurately fuels incredible efficiencies and reduces costs. "AI drives a significant amount of efficiency, and we're seeing that on the design side," says Bristow.

## Vision for the future

While it might feel like science fiction, fully autonomous flight is inevitable. Bell is once again leading the way forward, demonstrating to other aerospace manufacturers how to implement AI safely and successfully. Moving forward, they hope to take on even more use cases, such as training the AI-powered aircraft to fly in more complex scenarios and expanding AI use cases in their manufacturing operations.

"There are so many opportunities out there," says Hurst. "We're really just starting to scratch the surface."

**Jason Hurst**
*VP of Innovation, Bell*

**Grant Bristow**
*Innovation Technical Lead, Bell*


**Matthew Holvey**
*Sr. Manager of Intelligent Systems, Bell*

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