Amazing engines.

Dr. Brian Mitchell and his team develop the CFD software GE uses to design quieter, more durable and more efficient jet engines.

Consider the engine power required to get a plane off the ground. And then consider the engineering that goes into it.

Brian Mitchell does. Every day. The senior principal engineer at GE Global Research leads the development of GE's in-house computational fluid dynamics (CFD) code. Engineers utilize CFD to design better compressor blades, fan blades, turbine blades — all the stuff of the modern jet engine.

"What we do is write the software that GE Aviation uses to simulate the air flow in jet engines," says Dr. Mitchell.

In fact, engine design, CFD — and the powerful computers to process it all — have a strongly symbiotic relationship. Market demand for more fuel-efficient engines requires more creative designs. Those designs demand a more detailed understanding of the physics which in turn demands more advanced CFD. At the end — or beginning — of it all? Computational power.

"As computers have gotten exponentially more powerful, we've been able to go after increasingly sophisticated blade designs," Mitchell says. "A typical computational mesh used to be about 100,000 grid points. Now they run in the millions of grid points."

> "I decided early on that I liked programming. But what I loved was solving real-world problems. I still take pleasure from being able to take a computer and use it to solve something that impacts everybody."

For Mitchell and his team, it means they have to add more and more fidelity to the CFD solver to help engineers "chase the remaining inefficiencies" to reduce fuel burn.

For the rest of us, with the average medium-range airplane burning 750 gallons of fuel per hour, eliminating inefficiencies means less carbon and fewer pollutants in the atmosphere as well as lower air travel costs.

"Designs keep getting more aggressive," says Mitchell. "So we keep needing more resolved physics. One metric of that is if you look at how much CPU power we've used over time. That's trended exponentially." So much so that GE switched from clusters to supercomputers, equipping them with not only increased CPU capacity but the scalability to run large single jobs.

One recent success is the LEAP engine. Thanks to a combination of advanced aerodynamics, improved thermal designs for durability, and advanced materials — supported by Cray supercomputing power — the LEAP shows a 15 percent reduction in fuel burn.

While the challenge of making the most efficient engine possible has Mitchell looking forward to work every day, the thrill really comes from something deeper. "I've been programming computers for almost 40 years," he says. "I decided early on that I liked programming. But what I loved was solving real-world problems. I still take pleasure from being able to take a computer and use it to solve something that impacts everybody."

SYSTEM DETAILS

Cray® XE™ series supercomputer
Cray® XC™ series supercomputer

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