



C-DUS Lab Case Study



Sunstone helped aerospace engineer Miki Szmuk to build highly functional PCBs for small, unmanned aerial vehicles (UAVs).

The Challenge

Miki Szmuk is an aerospace engineer with big ideas for building better unmanned aerial vehicles (UAVs). As a doctoral student from the Controls Lab for Distributed and Uncertain Systems (C-DUS) of the Department of Aerospace Engineering at the University of Texas (UT) in Austin, Szmuk specializes in the engineering of small, sophisticated UAVs.

Szmuk and the rest of the C-DUS research group are advised by Dr. Maruthi Akella. The team focuses on addressing fundamental engineering problems in nonlinear dynamical systems, measurements, and control. This includes the coordinated operation of distributed multi-vehicle swarms. Consequently, the C-DUS research group employs UAVs in demonstrating various control and estimation algorithms that it develops.

These crafts are not easy to build. Weighing only a few pounds, UAVs must travel long distances—reliably collecting and processing data along the way. In order to meet the always evolving needs of the UAV industry, Szmuk recognized the need to develop PCB design skills.

Without them, it would be difficult to cost effectively improve functionality of his department's drones and get in front of industry expansion.

The Growing UAV Industry

Originally used for military or special operations, the UAV is now used for an increasing number of civil purposes. These include:

- Maritime or mountain search and rescue
- Monitoring of waterways, oil pipelines and civil engineering sites
- Disaster management
- [Crop management](#)

As the uses for UAVs become more diversified, design challenges will vary significantly depending on how it must function in the field.

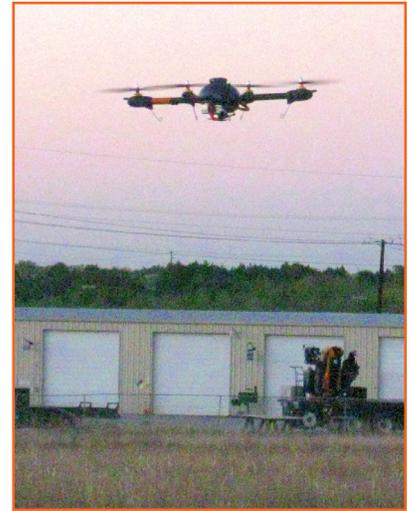
Partnering with Sunstone

“When it comes to drones, smaller is better, so payload size is critical,” said Szmuk.

Szmuk first reached out to Sunstone as an undergrad at UT. “I was working on a UAV with a two and a half pound autopilot system,” said Szmuk.

The vehicle’s overall size is a function of the payload it must carry and it took a twenty-five to thirty pound UAV just to accommodate the oversized autopilot. “That was simply too big for what we needed this plane to do,” said Szmuk.

Issues with size compound quickly when building a UAV. If the autopilot is too big, that impacts the wing area and fuselage size. The result is an oversized craft with less functionality and a higher cost.



“When it comes to drones, smaller is better, so payload size is critical,” said Szmuk.

The cumbersome, original UAV design was done component by component, thus the oversized end product. Szmuk took it upon himself to look at the bigger picture. “Looking at the plane, it was just a rat’s nest of wires,” he said.

Szmuk called Sunstone, looking not just for someone to manufacture boards but for a way to design them himself. With their help, he designed his first PCB—a small board that routed the plane’s wiring in a more organized and efficient way. The board helped reduce the size of the autopilot and enabled other refinements such as the replacement of a baseball-size sensor with a small chip.

“Once the board was integrated into the overall UAV design, we were able to keep making choices that made the plane smaller,” said Szmuk.

As the autopilot design evolved, the system shrank from its original weight of over two pounds down to just thirteen grams. As a result, the next version of the craft weighed just 20% of its predecessor.

“Once the board was integrated into the overall UAV design, we were able to keep making choices that made the plane smaller,” said Szmuk.

Easy as PCB123

Szmuk is an aerospace engineer, not a PCB designer. He needed the ability to design a board himself quickly and cost effectively. Sunstone’s design tool, PCB123, was a big factor in Szmuk’s choice of PCB manufacturing partner.

“It was safe to say I didn’t have a lot of design experience,” said Szmuk. “PCB123 had an intuitive user interface and a logical design process. Once I’d done the engineering work, connecting the schematic was like connecting dots.”

PCB123 provides even novice PCB designers like Szmuk with the confidence that their boards can be built, and built right. [Explore PCB123 today.](#)

More Projects, Better Designs

Szmuk continues to develop smaller, higher performance UAVs. Using PCB123 and Sunstone, he has made increasingly complex circuits to trim bulk and increase capabilities. “Even though PCB123 is really easy to use and I was able to teach myself a great deal, Sunstone did a lot to help me become a better designer,” said Szmuk.

A project funded through NASA required Szmuk to demonstrate novel guidance algorithms and build his smallest UAV to that point. These algorithms were geared towards improving the autonomy of unmanned climate science missions in the Arctic. “Sunstone was a big help on that one,” said Szmuk. “They had people take a look at my designs to make sure they were feasible and that really reduced our stress levels.”

“We offer unparalleled customer service, expertise and manufacturing capability to the PCB designer seeking to innovate and improve.”

- David Warren
*Sales and Business
Development at Sunstone*

Prioritizing Prototyping

David Warren, Sales and Business Development at Sunstone Circuits, explains his company’s emphasis on prototyping. “A lot of the bigger PCB manufacturers only care about board volume and simply do not make themselves available for smaller production runs,” said Warren. “We offer unparalleled customer service, expertise and manufacturing capability to the PCB designer seeking to innovate and improve. We are also the only PCB manufacturer that offers a real on-time guarantee. PCB orders will ship from Sunstone to meet the expected delivery date or we will automatically refund your money, plain and simple... no strings attached.”

Szmuk’s early projects required only a handful of boards be produced at a time, because the overall UAV design would evolve and the board requirements would change.

“Sunstone takes a long term approach to projects like Miki’s,” said Warren. “We made it possible for him to keep improving his UAV without busting the department’s budget.”

Learn more about Sunstone’s prototyping capabilities [here](#).

The Ongoing Partnership

Szmuk now relies on Sunstone to support all of his UAV projects. With Sunstone consistently making it possible for an engineer to excel as a PCB designer, Szmuk has achieved more with fewer resources.

Szmuk now pursues his doctorate and he trusts his PCB designs will produce the boards needed to break new ground in the unmanned vehicle industry. As that industry expands into a myriad of civil and public safety services, Szmuk knows his increasingly diverse and complicated projects will succeed without the outside help of a designer.

“After working with Sunstone for years, I’ve had a very good experience and they’ve never let me down. I’m very thankful for the work they’ve done,” said Szmuk.