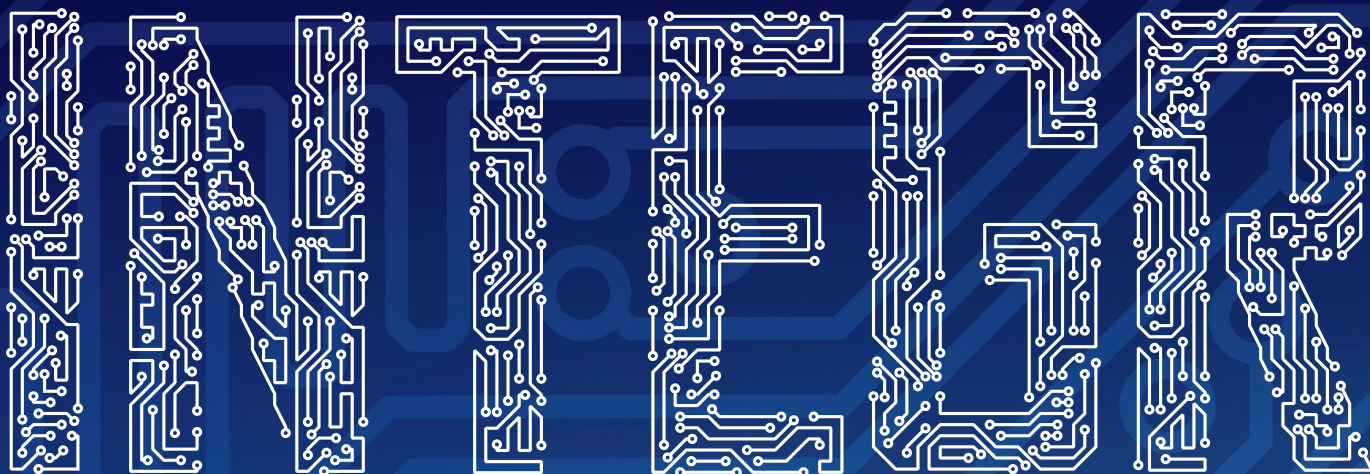
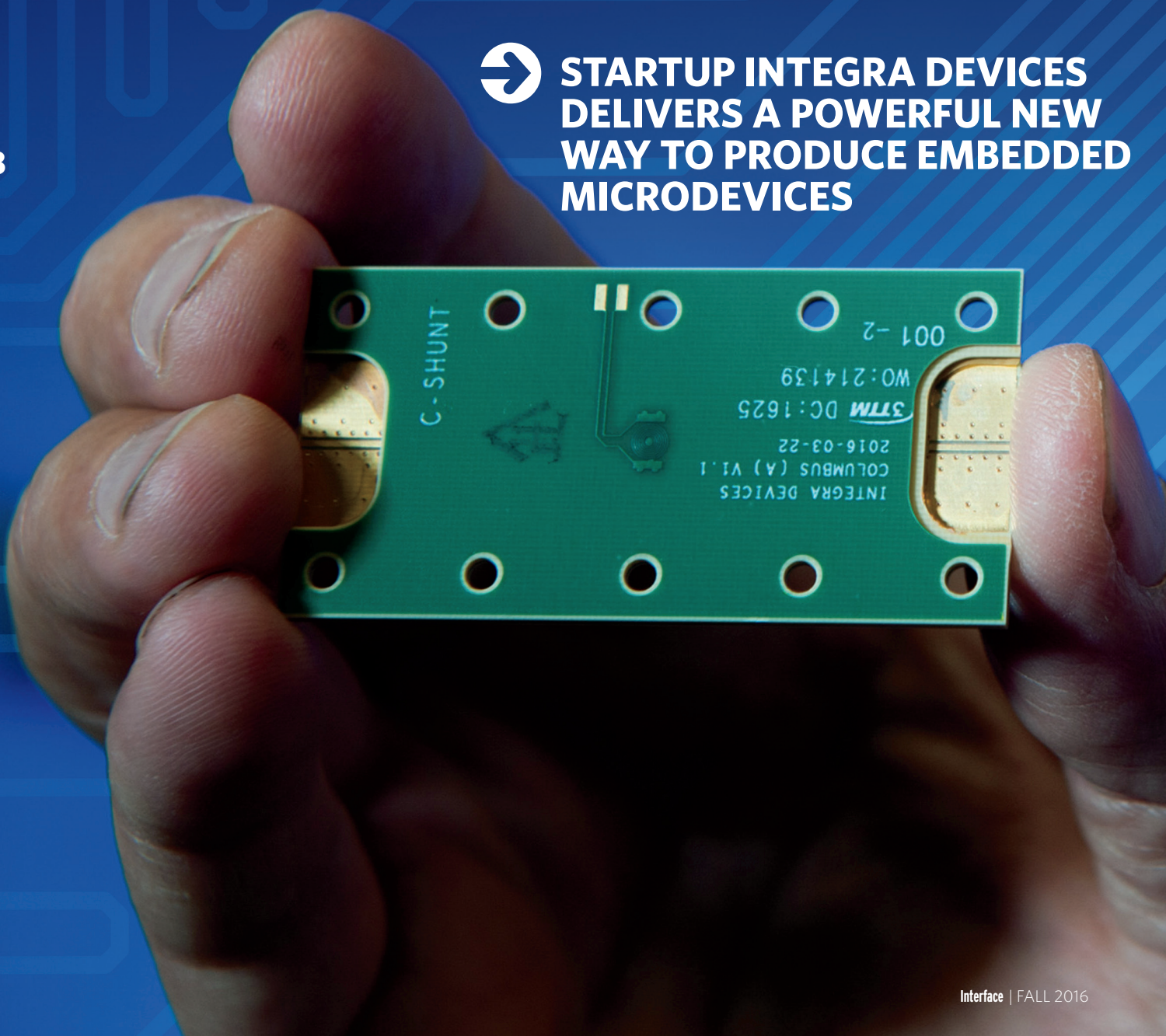


# INNOVATIVE



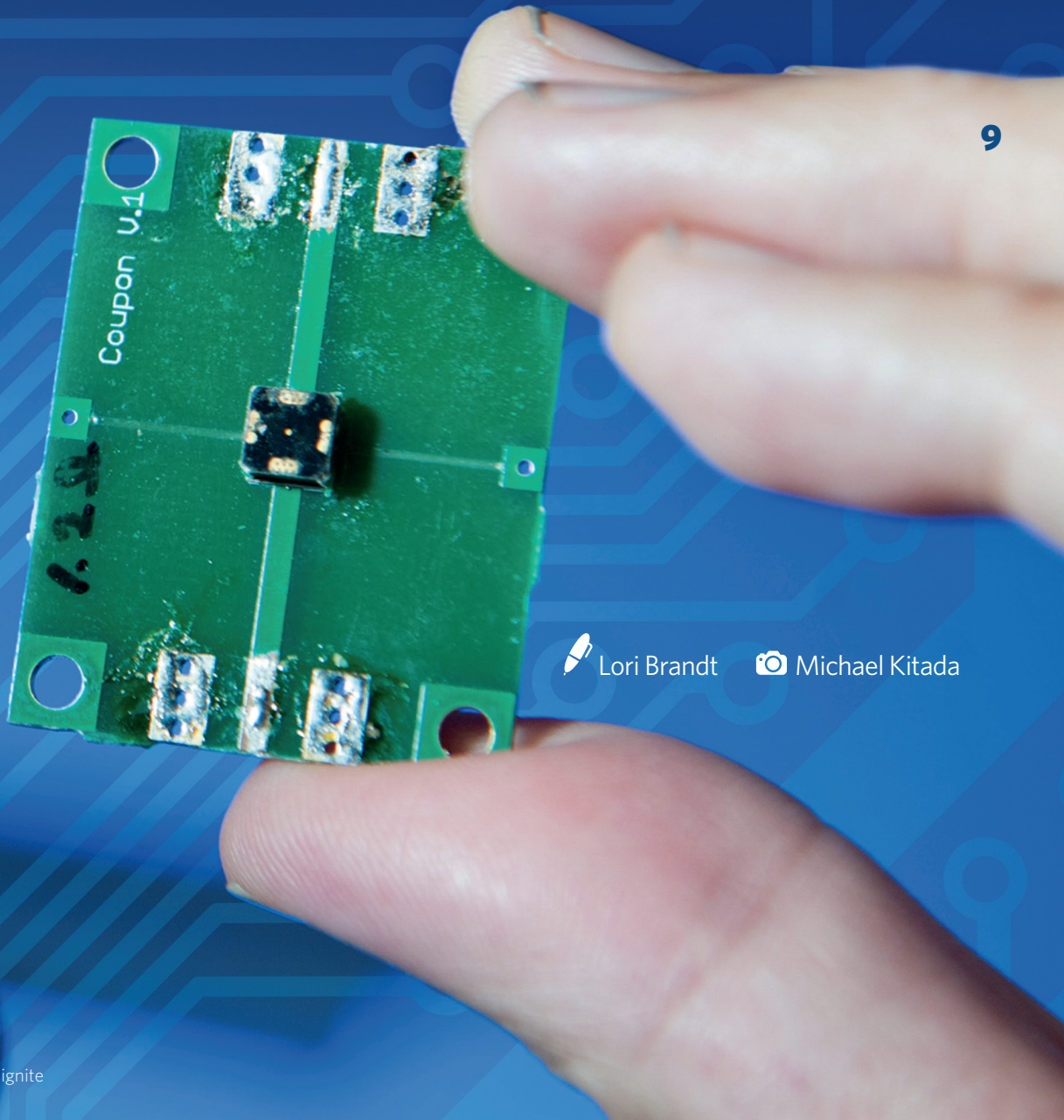
**STARTUP INTEGRA DEVICES  
DELIVERS A POWERFUL NEW  
WAY TO PRODUCE EMBEDDED  
MICRODEVICES**

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# ARTION



Lori Brandt



Michael Kitada

## It's no wonder Mark Bachman has a spring in his step these days.

Recently retired from UC Irvine's engineering faculty, the technology visionary and Internet of Things (IoT) evangelist has joined forces with two veteran high-tech industry entrepreneurs to found Integra Devices, a startup company with an eye toward the future.

Located in Calit2's TechPortal, the 1-year-old company is leveraging a newly patented manufacturing process for advanced 3-D microsystems (devices, sensors, relays, actuators). The technique, an alternative to silicon manufacturing, is well-suited to meet the high-frequency, high-speed and high-performance demands of fifth-generation (5G) communication networks and the Internet of Things.

During his 15 years as an electrical engineer at UCI, Bachman conducted research on microelectromechanical systems (MEMS), nanotechnology and micromanufacturing, working with Calit2 Director G.P. Li to establish the Integrated Nanosystems Research Facility (INRF) and BiON clean rooms. He is now applying that research to bring high-value products to industry. Integra Devices has licensed two patents from UCI, and is in the process of licensing several others, commercializing the manufacturing process and designs for a line of products.

"Most people use silicon technology to build really small things," says Bachman, Integra Devices chief technology officer. "Professor Li and I figured out a way to make high-performance microdevices using other materials like plastics, metals and ceramics for instance, and we can put them all together in a single package."

This technique, called Amalga, stacks the materials in laminate substrates as opposed to the flat monolithic process of silicon fabrication. It enables the miniaturization of devices and the integration of various materials, as well as allows the components to be embedded in substrate or printed circuit boards.

The method can be applied to many markets and applications, and it's a much more cost-effective approach than silicon. Bachman says the manufacturing technology does not require expensive capital equipment or clean rooms.

"Most can be done by retrofitting existing electronics manufacturing shops," he says. "Same tools, same people. It's an opportunity to upgrade to an advanced manufacturing process."

With private investor funding and Lockheed Martin as its first customer, Integra Devices has chosen a line of radio frequency (RF) electromechanical relays as its first product and has partnered with three local manufacturers.

"There are certain things that silicon cannot do," says Paul Dhillon, Integra Devices executive vice president of sales. "Miniaturized, high-power electromechanical RF/microwave relays have been the holy grail for miniaturization. [Our approach] is something that has never been done until now."

With the IoT gaining momentum, there will be billions of devices connected to each other: automated cars, smart homes, mobile phones and wearable sensors, along with things that haven't been invented yet. Microrelays, switches and smart antennas will be crucial to help users, devices and sensors all communicate for a smarter, more efficient society.



*As Integra Devices' senior engineer for research and development, Spencer Chang spends a lot of time in the Calit2 Microsemi Lab, where he tests advanced sensors.*




Once the company's approach is validated for microrelays, it's an incremental step to apply it to other devices, according to Integra Devices CEO James Spoto. "Mark can build all kinds of interesting microdevices in standard PCB manufacturing technology, with some obviously secret-sauce additions," says the former semiconductor industry engineer and executive. "We'll be going after the things that aren't well done in silicon; RF devices, flow sensors, audio sensors and actuators are a few examples."

Integra Devices' technology and products will help to meet the need for miniaturization driven by growing 5G, IoT, virtual reality, unmanned vehicles (drones), self-driving cars and wearables markets.

Bachman believes his company could help transform the microelectronic industry by bringing manufacturing back to the U.S. "The new 5G standard is a whole new ball game, it demands high-frequency and quality performance; conventional devices are not going to cut it. Smart antennas and microrelays, which can rapidly reconfigure themselves, will be a big deal in 5G."

Spoto, who has guided two previous startup companies through to successful exits, says the goal at Integra Devices is to build the company to significant revenue within four to five years. "Having Mark, the principal inventor on the technology, involved in the effort is a huge value."

The company recently hired two new employees - Sourabh Dhillon in business development and Spencer Chang ('14), a recent UCI biomedical engineering graduate - bringing its total workforce to five. They have one more year in Calit2's business incubator before they'll have to find another office location.

"I appreciate access to TechPortal's physical space and Calit2's excellent resources such as the electron microscopes and clean rooms," said Bachman. "But our main excitement in working at Calit2 is engagement with world-class research faculty, staff, students and industry partners." 

*Integra Devices Chief Technology officer Mark Bachman (left) and CEO James Spoto believe their company is well situated to meet the high performance demands of 5G and the Internet of Things.*