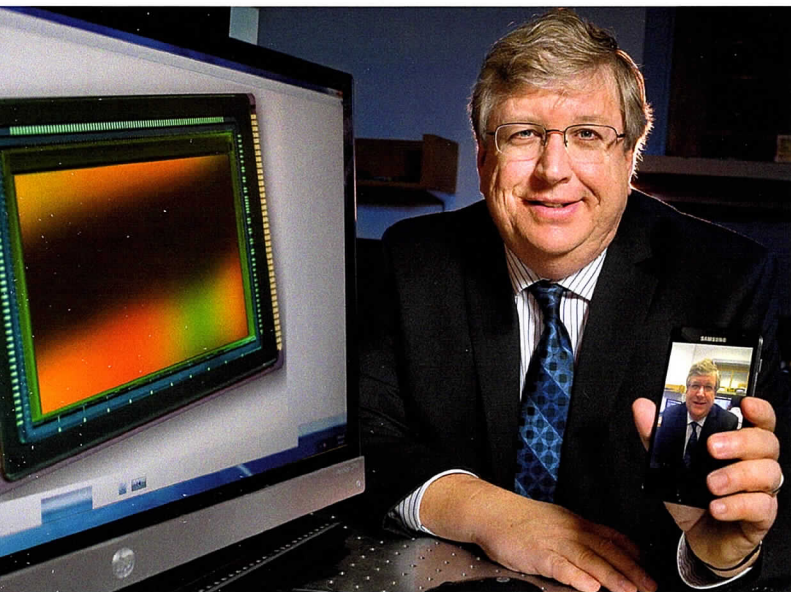


# THE Great Hall



NEWS FROM AROUND THAYER SCHOOL



## AWARDS

### Fossum Wins Highest Engineering Prize

**SELFIE PORTRAIT**  
Professor Eric Fossum earned Queen Elizabeth's seal of approval for the technology behind cellphone images.

**PROFESSOR ERIC FOSSUM, INVENTOR** of the CMOS (complementary metal oxide semiconductor) active pixel image sensor that is in every modern cell phone has been awarded the world's highest engineering honor, the Queen Elizabeth Prize in Engineering. Modeled on the Nobel Prize, the £1m award recognizes innovations in engineering that have globally benefitted humanity.

Fossum shares the prize with co-winners George Smith, Nobukazu Teranishi, and Michael Tompsett, who invented other key elements of digital imaging technology. Fossum, Teranishi, and Tompsett attended the announcement ceremony Feb. 1, 2017 in London, where Princess Anne represented her mother, the queen. The winners will be presented with the prize at a ceremony at Buckingham Palace later in the year.

Though Fossum is no stranger to recognition—he has been inducted into the National Inventors Hall of Fame and is a member of the National Academy of Engineering and a Fellow of the National Academy of Inventors, among other distinctions—the award

seems to have taken him aback. “All I can say is, holy cow, this is the biggest engineering prize in the world. This is utterly fantastic, and, to use the vernacular, I am gobsmacked. It’s really astonishing. It’s terrific and, well, I’m speechless,” he said at the conclusion of the announcement ceremony.

When Fossum invented the modern image sensor while working at the NASA Jet Propulsion Laboratory, his original goal was to miniaturize cameras for use in space. He ended up changing everyday life on Earth. Each year more than 3 billion cameras are made using CMOS image sensors, which are now essential to the worlds of entertainment, automotive safety, medicine, science, security, defense, and social media.

“Like most engineering achievements, mine came by standing on the shoulders of earlier engineers’ accomplishments,” Fossum told the Thayer community at a reception in his honor. “The QE Prize this year is a good example of that. George Smith co-invented the charge-coupled device or CCD at Bell Labs in 1969 along with the late Willard Boyle. Shortly thereafter, Mike Tompsett, also at Bell Labs, figured out how to use the CCD as an effective solid-state image sensor in 1970. When CCD technology was picked up by Japanese consumer electronics companies, many improvements were made. The best of these was the invention of the pinned photodiode by my friend Nobu Teranishi, then at NEC in the early 1980s. This device allowed much better low-light performance. The CMOS

image sensor, developed in the 1990s at the NASA Jet Propulsion Laboratory, used an active pixel with intra-pixel charge transfer to allow a micro-CCD in each pixel and permit good imaging performance in a baseline CMOS technology process—the same as mainstream microelectronics. The idea really took only a moment to come into being once I asked the right question, common with many inventions. And then it took a team of people to put it into practice, both at JPL and later at our spinoff, Photobit. After that, thousands of engineers around the globe continued to improve the technology and bring it to the level of the performance you find today in your smartphone.”

Now Fossum and his PhD students, including Saleh Masoodian, Jiaju Ma, and Dakota Starkey, are working on what may be the next major breakthrough in imaging technologies: a quanta image sensor that can count every photon for use in low-light conditions. A Dartmouth spin-off company is in the works. In addition, Fossum, who joined the Thayer faculty in 2010, is sharing his entrepreneurial expertise as director of Thayer’s PhD Innovation Program and as the newly appointed associate provost for Dartmouth’s Office of Entrepreneurship and Technology Transfer.

“All of you know something about Eric,” Dean Joseph J. Helble said at the Thayer reception. “Few of you know how transformative his work has been, and how deeply engaged he is in the life of this university. Eric, we are deeply honored to have you at Thayer, and proud of what you have done as an engineer for the world.”