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LOCAL & REGIONAL

Dartmouth Professor Wins Prize for Shrinking Digital Cameras

By DAVID BROOKS
 The Concord Monitor

HANOVER — When you're talking to a guy who won what is sometimes called the Nobel Prize of engineering for helping make smartphone cameras possible, you want to hear a good "Eureka!" story.

The first (and still the best) of such stories, of course, came when Archimedes leapt from his bath and ran down the street in naked excitement after discovering displacement. But science is full of them — my fa-

vorite being William Hamilton using his pocketknife to carve quaternion equations on a bridge abutment after inspiration hit when he had no paper or pencil.

So when I called Eric Fossum at Dartmouth to talk about receiving the Queen Elizabeth Prize for Engineering, I immediately asked for his Eureka story.

Alas, no bathtubs and no pocketknives.

"Unfortunately, it wasn't like a giant light bulb went off in my head. Sorry," Fossum said. "I have had other ideas that were 'aha' moments," he added helpfully. "But unfortu-

nately the ideas turned out to not be as good. Oftentimes you think you've got a great idea, only to discover that you're not the first person to have the idea. That has happened to me many times."

Darn you, reality — always getting in the way of a good article.

Fossum is a professor at Thayer School of Engineering and director of its doctoral innovation program. He recently received the Queen Elizabeth Prize for his role in helping create the "camera on a chip" that shrunk imaging systems enough to put in smart-

phones. He'll share the \$1.25 million prize with three other researchers, including one who has already won a Nobel Prize. He said he'll use much of his prize to boost Camp Invention, a program for STEM education in elementary schools.

What did Fossum do to be part of the trio of these biennial prizes from the British government? He helped figure out how to replace CCD with CMOS.

That didn't mean much to me, either, until Fossum explained.

CCD, which stands for charged couple de-

vice, was the obvious technology to replace film as photography went digital. Obvious but not terribly efficient, which is why early digital cameras were big, expensive and consumed batteries like nobody's business.

Fossum and many others realized that CMOS, as in complementary metal-oxide semiconductor, "the recipe that almost all modern electronics are made out of," would be more efficient and lead the way to smaller, less power-hungry cameras.

How so? Fossum gave a technical analogy

SEE PROFESSOR — B5

A Great Day for a Ride



Sunapee Voters Will Decide on School Board

Fire Department Governance Also on Town Meeting Agenda

Voting on the Sunapee town and school warrants is Tuesday, March 14, from 8 a.m. to 7 p.m. in the Sherburne gymnasium.

By PATRICK O'GRADY
 Valley News Correspondent

SUNAPEE— A contested race for two School Board seats and petition articles calling for a change in the governance of the fire department highlight the school and town warrants this year.

John Augustine, a Selectboard member, Veronica Hastings, Jesse Tyler and Edward Ander-

The proposed school budget of \$12 million for the fiscal year beginning July 1, represents a \$262,000, or 2.2 percent, increase from this year.

The major drivers of the increase are the second year of a teachers' contract, health insurance and New Hampshire retirement obligations, Holden said.

Also on the warrant are two articles of \$25,000 each to put money into the special education trust fund and school facilities capital reserve fund, with the money to come from a projected surplus at the end of the current fiscal



Chelsea Weighs Full-Time Administrator Professor Wins Prize

Chelsea's School District Meeting will be held on Tuesday, March 7, at 9 a.m., with Town Meeting to follow. Both take place at Chelsea Town Hall. Voting is from the floor.

By AIMEE CARUSO
Valley News Staff Writer

CHELSEA — Town Meeting voters will elect a dozen town officials and weigh in on relatively flat budgets.

Like last year, the proposed town budget would provide for an increase in hours for the town administrator position, a change supporters say is necessary if Chelsea wants to do more than just tread water in an ever-rising sea of state and federal regulations.

Last March, Town Meeting voters shot down the proposed \$1.1 million town budget, under which the amount to be raised by taxes would have increased by almost a third, to \$775,000. The proposed plan included \$30,000 to expand the town administrator position from part time to full time. Several residents at the meeting said they supported bumping up the hours but wanted details about how the increased time would be used.

In a subsequent special Town Meeting, voters approved a budget that was \$74,000 less than the initial proposal, and did not provide for expanding the town administrator position to full-time.

The town is subject to a lot more regulations than it was even 10 years ago, and while Selectboard members attend trainings and read the available relevant information, "we still need someone to make sure ... we are kept current," said Selectboard Chair Joan Goodrich. The town clerk and town treasurer have done "an amazing job" staying on top of things, "but it's just too much work."

The town administrator position was previously held by Karen Lathrop, who is also town clerk. Lathrop resigned from the town administrator position in November.



Chelsea recently hired Maggie Kerrin, of Waterbury, Vt., for the 20-hour-a-week position, with the understanding that it may expand to 30 hours, Goodrich said. The additional hours would enable them to tackle policies and ordinances that require updating and assess the town's needs and track down relevant grants.

The Selectboard also wants to work hard on economic development, which the town administrator would be able to help facilitate, Goodrich said. "Right now all you can do is try to keep up with the day-to-day."

Kerrin, a Vermont native, started work last month. She also is town administrator for St. George, a Chittenden County town with about 700 residents. That position is also part time.

A "meet and greet" Feb. 11 at Chelsea Town Hall was an opportunity to introduce herself to residents and talk with them about their concerns, which include FEMA buyouts related to Tropical Storm Irene, Kerrin said. "It's something I definitely want to delve into and see the history there and where we're at."

Her goals as town administrator include learning more about Chelsea's transfer station, wastewater system and highway department, and accomplishing as much as she can for the Selectboard. "I want to give them the best support I can" and be a good assistant for residents, said Kerrin, who shares an office with the town treasurer. "I am here for them also."

The proposed \$1.1 million town budget represents an increase of \$38,000 over 2016, and would require \$690,000 to be raised by taxes. It includes a \$112,000 budget surplus, carried over from 2016, to help allay taxes.

The majority of the budget is highway, said Goodrich, adding a plug for the department. "We have two and a half employees and some of the

best roads in the state."

It also includes payments of several bonds — on the water system, sewer plant and new garage — totaling \$98,000, and \$48,000 to fund the 30-hour Town Administrator position.

The current tax rate is 63 cents on \$100 of appraised value. Earlier this week, Jane Cushman, town treasurer, said she had not yet calculated the projected tax rate under the proposed budget.

Selectboard seats held by Susan Elder, Gregory Kotyk and Ruben Hook will become open, as each finish terms this year. Elder said she will run again, for either a three- or two-year seat, and Kotyk plans to run for his seat, which has one year remaining. He was appointed to the Selectboard after Selectman Michael Button moved out of town. A telephone message for Hook was not returned.

The proposed \$3.4 million school budget is \$65,000 less than the current budget. The proposed budget is "pretty much in line other years," said Joe Spinella, School Board chair. Nonetheless, taxes would go up under the plan, in large part because of fewer tuition students.

To comply with Act 46, Chelsea and Tunbridge School Districts have proposed merging to form the First Branch Unified School District, which would likely lead to the closure of the small high school in Chelsea as early as the 2018-19 school year. Instead, First Branch would be a preK-8 district. High school students in both Chelsea and Tunbridge would have school choice. While the change may be positive in the long run, in the short run short run, the possibility that Chelsea's high school could close "creates anxiety" for prospective tuition students, Spinella said.

Under the proposed budget, the homestead tax rate is expected to increase from \$1.58 to \$1.66 on \$100 of assessed value, which translates to a \$200 increase on a home valued at \$250,000.

Voters also will elect School Board members to fill a two-year and a three-year seat.

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in a 2015 story in *Dartmouth Engineer Magazine*.

Imagine that the pixels in a digital camera are thousands of 5-gallon buckets covering a football field, he said. The pixels measure light at each point, and the buckets collect rain at each point.

To empty a bucket in CCD, which is the analogy for getting information out of a pixel, "you have to transfer the charge packet that represents the accumulated photoelectrons step by step across the chip without losing many electrons," he told the magazine. Doing that quickly requires a lot of power and is relatively hard to miniaturize.

With CMOS, however, each bucket can be emptied directly, rather than step by step via its neighbors. That is quicker and easier, by far. This was obvious to everybody, said Fossum, but CMOS was too "noisy" — resulted in too many false signals — to create good photos, so it wasn't used.

At the time in the 1990s Fossum worked at the Jet Propulsion Laboratory, where engineers really wanted lighter cameras for weight-conscious space flight. He figured out a way to reduce the CMOS noise through a process called intrapixel charge transfer, which measures the charge before and after a pixel is hit by photoelectrons.

This is where the "Eureka" moment should have occurred, but he says the answer was actually developed over time. Part of the delay was due to an odd-sounding obstacle: His insight seemed too obvious. "It wasn't that difficult, but what was really difficult was to answer the question: This is so straightforward, surely other people have thought of this and it didn't work," he said.

But they hadn't thought of it and it did work. End of story? Far from it. "It was a good five years of gov-

ernment research and development, then trying to transfer that technology to U.S. industry. We traveled to many U.S. companies to convince them they should commercialize this but nothing came of it," said Fossum. "There was a feeling like we're going to miss this window of opportunity if we don't do something ourselves, and that really motivated the spinout of Photobit."

Started by himself and his wife, Sarah Kemeny, Photobit eventually grew to 125 employees before they sold it in 2001. The field really took off when mobile phones provided a vast new market for small digital cameras. The usefulness — ubiquity, really — of this technology undoubtedly contributed to the prize, which has previously gone to the inventors of the internet and the World Wide Web, and to an MIT chemist whose work controlling the delivery of drugs with large molecular weights has been cited for saving up to 2 billion lives. The Queen Elizabeth Prize values impact at least as much as originality.

Fossum admits that luck is a big part of such impact. "CMOS happened just at the right stage of advancement at the time of the need for cameras in smartphones emerged. That was a very happy coincidence," he said.

Fossum, 59, came to Dartmouth in 2010 after getting restless with semi-retirement in New Hampshire.

"One of my jobs here is to help promote entrepreneurship among faculty, try to spin out companies," he said. I think the younger faculty at Dartmouth are very interested in entrepreneurship opportunities.

"Some of the more senior faculty sometimes have the feeling that it's not pure if you're doing something that has applications, but even among them that attitude is shifting. It will be pretty much be dissipated in the not-so-distant future."

Sunapee to Decide on School Board, Fire Department

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Donna Nashawaty said.

"Sixty percent is for employees' expenses such as step plan and increases in the rates for New Hampshire retirement. There are no major policy or spending increases," the town manager said.

There is \$485,000 more in eight warrant articles to put money into various reserve funds, which is what the town does every year. Two articles seek approval to withdraw money from reserve funds to buy a dump-plow truck for the highway

the fire department. Voters will also be asked to spend \$45,000 from the hydroelectric fund for the first of three phases to build a cold storage building at the highway garage. In preparation for the town's 250th anniversary in 2018, an article would establish a fund for the event and place \$15,000 in it from the budget fund balance.

If all town spending requests are approved, the town tax rate is projected to increase no more than 39 cents, assuming no increase in the grand list, Nashawaty said.

ment would disband the board of fire engineers and have the Selectboard, town or town manager appoint the chief, with the chief appointing firefighters. The fire engineers board handles both duties now.

If voters reject the proposed dismantling of the board, a related article would prohibit active firefighters from serving on it, which they do now. They would have to either resign from the board or fire department, the article states.

The ballot includes several zoning articles proposed by the Plan-

change opposed by the board. The petitioned article seeks to allow mixed use, including commercial ones, along Route 11 from Jobs Creek Road in Georges Mills to Browns Hill Road.

If all spending proposals on both the town and school warrants are approved, the combined town and local school tax rate is projected to increase 84 cents to \$10.51 per \$1,000, adding \$210 in property taxes to a home assessed at \$250,000.

Cornish

New Hampshire School District

PUBLIC NOTICE CORNISH SCHOOL DISTRICT

The Annual School District Meeting for the Town of Cornish will be held on Saturday, March 11, 2017, with voting from 10:00 AM to 7:00 PM at the Cornish Elementary School.