BEN BISHOP

26% in 2014 to 15.4% by 2015, says its editor-in-chief Randy Schekman, a cell biologist at the University of California, Berkeley. That's approaching the acceptance rates of *Nature* and *Science*, which are both below 10%.

In 2013, Schekman denounced *Nature*, *Science* and *Cell* as "luxury journals", and likened their low acceptance rates and high impact factors to high-end "fashion designers" that artificially stoke demand for their brand through scarcity. Now, he says, *eLife* has become "more selective than I had imagined, but it's not based on any instructions I have conveyed to the editors. It's based on their sensibility of important work."

In 2014, the most recent year for which financial information is publicly available, *eLife* published 537 research articles with expenses of £3.4 million — equating to around £6,300 for each article. "It appears to be a very expensive way to innovate in the publishing space," says Binfield.

The journal says that its per-article cost has dropped — to £3,522 in 2015. It points out that it spends money on technology development, too. Six publishers that use the third-party publishing platform HighWire have tested the *eLife*-developed Lens display technology, for instance. Schekman says that *eLife* plans to diversify its income by asking governments and other charities for funding. It will also eventually charge scientists to publish in the journal. But it won't, he says, establish other open-access journals that accept more papers and have lower selectivity — a strategy that some have used to shore up finances. "We have no interest in creating other lesser journals with lower standards," he says. ■

eLife BY THE NUMBERS

£43 million

Amount committed to the journal over ten years (2012–22) by the Wellcome Trust, Howard Hughes Medical Institute and Max Planck Society.

848

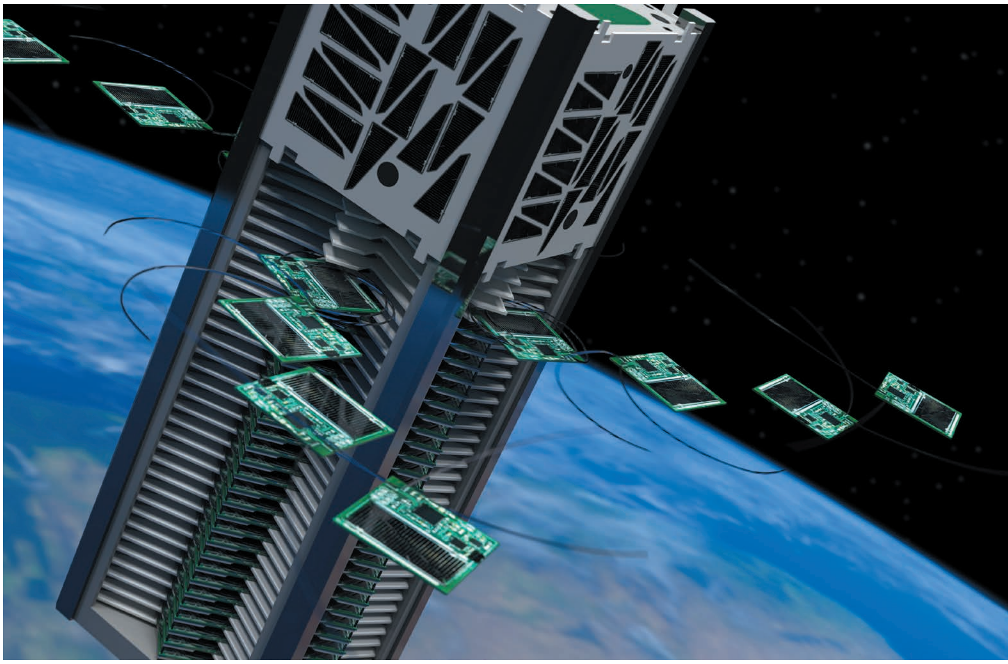
Research articles published in 2015 — all open access.

116 days

Median time to acceptance of paper, 2015.

15.4%

Acceptance rate in 2015.



A KickSat satellite (artist's impression) will launch several minuscule chipsats.

SPACE

First flight for tiny satellites

Launch of 'chipsat' probes in July will test a new way to explore the Solar System — and beyond.

BY NICOLA JONES

On 6 July, if all goes to plan, a pack of about 100 sticky-note-sized 'chipsats' will be launched up to the International Space Station for a landmark deployment. During a brief few days of testing, the minuscule satellites will transmit data on their energy load and orientation before they drift out of orbit and burn up in Earth's atmosphere.

The chipsats, flat squares that measure just 3.2 centimetres to a side and weigh about 5 grams apiece, were designed for a PhD project. Yet their upcoming test in space is a baby step for the much-publicized Breakthrough Starshot mission, an effort led by billionaire Yuri Milner to send tiny probes on an interstellar voyage.

"We're extremely excited," says Brett Streetman, an aerospace engineer at the non-profit Charles Stark Draper Laboratory in Cambridge, Massachusetts, who has investigated the feasibility of sending chipsats to Jupiter's moon Europa. "This will give flight heritage to the chipsat platform and prove to people that they're a real thing with real potential."

The probes are the most diminutive members of a growing family of small satellites. Since 2003, researchers have launched hundreds of 10-centimetre-sided CubeSats — more than 120 last year alone. Engineer Jekan Thanga at Arizona State University in Tempe is now working on an even smaller 'femto-satellite', a 3-centimetre cube that he says has the technological capacity of the first CubeSats. Chipsats, which are smaller and cheaper still, are seen as disposable sensors that could be sent on suicide missions to explore hostile environments, such as Saturn's rings.

"They're all part of the toolbox for next-generation space missions," says Thanga.

The upcoming chipsat test, called KickSat-2, is the second incarnation of a crowdfunded mission developed by researchers at Cornell University in Ithaca, New York. The shoebox-sized KickSat-1 spacecraft successfully launched on 18 April 2014, but it failed to deploy its cargo of 104 chipsats after a cosmic radiation burst reset the clock on its release mechanism. The ▶

craft fell out of orbit and burned up with the chipsats still in its hold.

"I was a little bummed out," says Zachary Manchester, an aerospace engineer who built the satellites as a doctoral student in aerospace engineering at Cornell. Fortunately, enough spare parts were lying around to make a second batch relatively quickly and easily.

The chipsats, called Sprites, carry little more than a pair of 60-milliamp solar cells, a radio and an antenna. The KickSat-2 payload includes some newer Sprites that can 'sail' by tilting towards or away from the Sun. A current is run through a coil, turning the chip into a compass needle that aligns with Earth's magnetic field, allowing the chipsat to control its orientation. The probes can be reprogrammed on the fly from the space station.

Sprite prototypes have already proved that they can survive the rigours of space. In 2011, three chipsats were attached to the outside of the space station. They were still working when scientists retrieved them in 2014.

That commercial electronics are good enough to survive space's vacuum and extreme temperatures is a "pretty big deal", says Mason Peck, an aerospace engineer who leads Cornell's chipsat team. But on a flight into deep space, chipsat electronics would face a high risk of damage from radiation. "There are some clear paths to radiation hardening, but it's expensive," says Peck. "And that's not the point. You don't want to make an exquisite satellite. You just launch a million; if only 1% survive then that's fine. You put statistics on your side."

There is plenty of science that Sprites can do closer to home. Peck says that the tiny satellites could be used to verify models of how small bits of debris behave in the upper atmosphere. Like feathers on Earth, the small, flat objects would be heavily affected by drag. "We're not very good at modelling that," says Peck. Another potential project would be to use Sprites to make a high-spatial-resolution map of Earth's magnetic field.

"That would be really useful," agrees Jeffrey Love, a geophysicist with the US Geological Survey in Denver, Colorado, who studies Earth's magnetism. "Ideally you'd want to be measuring it everywhere all the time. This could be a step in that direction."

For the long-term interstellar goal, chipsats will need much better laser-communication capacity. That should be possible, say Peck and Manchester, who are both on the Breakthrough Starshot advisory committee.

"We have gone a long way towards proving we can have a functional tiny craft," says Peck. ■

MATTHIEU COLIN/ITER

The gigantic ITER project is currently under construction in southern France.

NUCLEAR PHYSICS

US urged to stay in fusion project

Department of Energy says US should fund ITER until 2018.

BY DAVIDE CASTELVECCHI & JEFF TOLLEFSON

The troubled nuclear-fusion experiment ITER has received a cautious vote of confidence from the US Department of Energy (DOE). The multibillion-euro project has improved its performance and management, and the United States should continue to support it, at least until 2018, the DOE said in a report to Congress released on 26 May. But after that, the agency said, the country should re-evaluate its position.

ITER is a collaboration between the European Union, China, India, Japan, South Korea, Russia and the United States. Its goal is to show that fusing hydrogen nuclei to make helium — the same process that heats up the Sun and powers hydrogen bombs — is a technologically feasible way to produce electricity.

The reactor is under construction in St-Paul-lez-Durance in southern France, but the work is more than a decade behind schedule, and its costs have spiralled. The latest report comes against a backdrop of criticism directed at ITER's former management.

The DOE acknowledges ITER's scientific potential, and the substantial improvements since current director-general Bernard Bigot took over in March 2015. "ITER remains the best candidate today to demonstrate sustained burning plasma, which is a necessary precursor to demonstrating fusion energy power," US energy secretary Ernest Moniz writes in the report's introduction. But the agency says that the progress "must be balanced against several years of inadequate performance". Its recommendation to continue US funding for ITER is contingent on continued and sustained progress on the project, increased transparency and a suite of management reforms.

"I think it's an outstanding report that says all of the right things," says William Madia, a former director of Oak Ridge National Laboratory in Tennessee who led an independent review of ITER in 2013. That report excoriated the way in which ITER was run, and proposed reforms to save it from failure — recommendations that ITER's governing council embraced.

Madia says that the DOE is appropriately encouraged by recent management changes, and appropriately cautious about whether the project is actually back on track. "Bernard is doing a terrific job, but, my goodness, he's got a lot of work to do," he says. Bigot acknowledges this, and says that the DOE's conclusions are