Rewards and risks for physicist entrepreneurs

The article "Risky business: A study of physics entrepreneurship," by Orv Butler and Joe Anderson (PHYSICS TODAY, December 2012, page 39), provides a good description of how scientists produce new products for the US marketplace. But the risk involved, combined usually with the need to abandon previous research directions, has limited the appeal of entrepreneurship as an alternative career path.

An interesting subset of entrepreneurial firms have overcome those two challenges: In them, physicists continue to develop their pure research interests and also are able to mitigate the risk of entrepreneurship while still producing commercially successful products. Such firms are more likely to stir the imagination of young physics graduates.

A prominent example is American Science and Engineering, founded in 1958 by several MIT physicists, including Bruno Rossi. Pioneering work in x-ray astrophysics carried out at AS&E in the 1960s and 1970s earned the group's leader, Riccardo Giacconi, a share of the 2002 Nobel Prize in Physics. In parallel with that research, AS&E developed the first x-ray baggage scanners and became a publicly traded company with international sales of more than $200 million in a wide range of x-ray detection equipment.

Another example is Cambridge Research and Instrumentation, which I and three colleagues founded in 1985. At CRI, scientists were able to pursue several topics in solar plasma physics and luminosity variation, which led to more than 50 refereed papers, including cover articles in *Nature*, *Science*, and *Scientific American*. At the same time, the company developed several lines of commercial products, such as cryogenic radiometers for metrology and liquid-crystal scanning filters for biomedical imaging. The firm was recently acquired by PerkinElmer.

In the cases of AS&E, CRI, and other, similarly successful firms, pure research was encouraged. It attracted first-rate scientists whose expertise and connections sometimes strengthened the commercial products. Also, research funding from NASA, NSF, the National Oceanic and Atmospheric Administration, and the departments of Defense and Energy helped to cover overhead and mitigate risk. Federal funding available to entrepreneurs extends beyond the Small Business Innovation Research and Small Business Technology Transfer sources that Butler and Anderson discuss. Private firms can compete successfully in the same grant programs that are open to universities and government labs, with the only provision being that NSF grantees may not charge a fee for performing the proposed work.

A startup that encourages research in fields unrelated to commercial products and that seeks to provide steady employment for its scientists is usually not attractive to venture capitalists or angel investors. However, it can offer a career path at least as rewarding as one at a university or government laboratory and no more risky. Entrepreneurship takes time away from research, but then so do teaching and administrative duties at academic or government institutions.

The high national failure rate that Butler and Anderson report for startups may be accurate for purely commercial enterprises. But none of the research/commercial entrepreneurships familiar to me has failed. None has turned into a Google or Apple to please venture capitalists, but all have done well for their physicist founders. They offer a career path that deserves a closer look by physicists and by the American Institute of Physics.

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■ **Butler and Anderson reply:** We appreciate Peter Foukal's comments and the examples that he provides. However, based on interviews over the past four years with physicist founders of 91 companies, we believe that physics startups are high-risk ventures in today's economy, and those that succeed today must focus on more than research. Foukal's two examples were founded in 1958 and 1985 during a different economy, when even corporate giants like AT&T and GE funded blue-sky, pure research. We described the move away from that economy in our previous article "Industrial R&D in transition" (PHYSICS TODAY, July 2009, page 36). Our data on more recent startups indicate that in today's economy, companies committing substantial funds to pure research are essentially betting on the lottery. Are there winners? Yes, but they are sufficiently rare that they don't provide an effective business model for physicists starting their own companies. Recent changes in Small Business Innovation Research and government grant policies further discourage funding a company based on pure research that has little or no focus on commercialization.

The companies that we investigated probably provide a better example of current practices. Our database suggests that for better or worse, most companies operating as Foukal advocates have already gone the way of Bell Labs. Nor would we expect PerkinElmer to continue Cambridge Research and Instrumentation's blue-sky research practices. They have, after all, fiduciary obligations to their investors. Nor do we think that the physicist founders of the companies we studied would agree that their business models have "limited the appeal of entrepreneurship as an alternative career path." Many physicist entrepreneurs we interviewed told us they would prefer to transform their research into commercial products affecting the lives of millions than to publish papers read by only a few.

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Letters and commentary are encouraged and should be sent by email to ptletters@aip.org (using your surname as the Subject line), or by standard mail to Letters, PHYSICS TODAY, American Center for Physics, One Physics Ellipse, College Park, MD 20740-3842. Please include your name, work affiliation, mailing address, email address, and daytime phone number on your letter and attachments. You can also contact us online at http://contact.physicstoday.org. We reserve the right to edit submissions.