

An Entrepreneur's Commentary on Startup Lessons Learned

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A Little about Richard Fauconier, Ph.D.

- ▶ Principal Electrical Engineer and co-founder of Precisyx, LLC.
- ▶ Former high school teacher of mathematics, physics and electronics.
- ▶ Former adjunct professor at New York City Technical College.
- ▶ Former salaryman in the defense industry, working at companies large and small.
- ▶ Over 17 years experience as developer or co-developer of electronics subsystems and algorithms for radars, communication systems, and infrared spectroscopic systems.
- ▶ Holder of patents in the field of infrared spectroscopic systems.
- ▶ Ph.D. in electrical engineering from Rensselaer Polytechnic Institute.

Topics

Nothing herein is meant to be a rigid rule. These are merely suggestions: things that worked for me.

- In this talk, I'll touch on
 - Bootstrapping
 - Employees
 - SBIR grants
 - Intellectual property ("IP")
 - Some observations about electronic systems startups

Bootstrapping

- ▶ Bootstrapping should persist beyond some lump sum of an initial investment (e.g. savings, 401k cashout, loan from family members, et cetera).
- ▶ Bootstrap for the long haul; Murphy's Law decrees that setbacks will occur along the way to developing, manufacturing and marketing your product. Your business must survive the inevitable setbacks.
- ▶ Consulting can often provide an initial revenue stream with potential for growth. Precisyx's first sizeable consulting contract was a word-of-mouth referral by someone who was familiar with my work.
- ▶ A non-innovative, conventional business can also provide unglamorous, but steady, revenue. Franchise operations are a good candidate.
 - ▶ It is good to keep both business operations in one company for a while: makes it easier to get loans for working capital, etc.
 - ▶ The "unglamorous" business arm must be run by a reliable manager who knows the overall goals of the business, and wholeheartedly embraces them.
 - ▶ The techie founder must be at least 80% unencumbered by the low-tech side of the business. Must have a free hand to focus on the high-tech side.
 - ▶ Use an accounting service to setup your accounting system properly. If the high-tech side contracts with the Department of Defense, your accounting system needs to be SF1408-compliant.

Employees

- ▶ Hire right. Seek knowledge first, then conscientiousness, creativity and initiative. Try to get knowledge + at least one of the other qualities in the same person. You're lucky if all qualities reside in any one employee.
- ▶ Give people freedom to fail. But you should see an earnest effort to get the matter right on the next try.
- ▶ You need to set an example. "Do as I say, not as I do", doesn't cut it.
- ▶ You may have to help develop your employees' knowledge base. At the same time, you will learn quite a bit from the best of your employees.
- ▶ Nevertheless, there are minimum requirements for knowledge. I once knew a degreed electrical engineer (B.S. from a US university) who could not extract relevant information from component datasheets, nor could he figure out the power consumption of a circuit board from the datasheets of its various components.
- ▶ It is ok for your employees not to know everything. However, in a small company, if an engineer needs to be handheld and told what to do every step of the way, it means that the handholder is basically doing two jobs. This seriously impairs the handholder's productivity and effectiveness.
- ▶ Be sure that your employees sign proper non-disclosure agreements and intellectual-property ("IP") assignments. Each engineer is performing a "work for hire"; the IP belongs to your company.

SBIR Grants

- ▶ Small Business Innovation and Research (“SBIR”) grants are an important source of non-dilutive funding. See sbir.gov.
- ▶ These opportunities usually come from government departments that can’t find what they want off the shelf on the open market. Hence a hefty bit of product innovation is necessary.
- ▶ The government solicits competitive bids on sbir.gov.
- ▶ SBIR grants are usually hard to get (a success rate of between 10% and 16% is common).
- ▶ Writing a proposal for an SBIR bid eats up a huge amount of valuable engineering and administrative time for a very uncertain outcome.
 - ▶ But chance favors those who are prepared. If you pursue your sound product idea with dogged persistence, regardless of outside funding, chances are that the Departments of Defense, Homeland Security, Agriculture, etc., may need what you’re developing. That makes it possible to repurpose much of what you’ve already done (fewer labor hours!) for a proposal, with a much greater chance of success.

Intellectual Property (“IP”)

- ▶ Patents and trade secrets are two of the most important forms of intellectual property.
- ▶ It is important that a tech founder have some basic knowledge about these for him or herself. Nolo Press has some good books on these topics—www.nolo.com.
- ▶ A good patent attorney is still necessary—I use ENET’s own William Mansfield, Esq.
- ▶ If you think you’ll have trouble keeping something a trade secret, it may be worth applying for a patent on it instead. If you do apply for a patent, you should find a scientific or engineering journal in which to publish any scientific findings relevant to the patent. This has multiple benefits:
 - ▶ If you do apply for an SBIR grant, you don’t have to explain every excruciating detail of a complex system in your 20-page technical proposal. You can refer to results from your publications.
 - ▶ For a US patent, you have up to one year post-publication to file either a patent application or a provisional patent application.
 - ▶ A publication that precedes a competitor’s patent application will prevent him or her from getting a patent on an invention that’s essentially similar to yours.

Intellectual Property (cont'd)

- ▶ Be careful of whom you pick as a collaborator on any publications. Ensure you have an agreement for assigning and licensing any resulting patents. People have been known to suddenly turn on their colleagues in a bid for full ownership; often psychological issues beyond pure logic are involved.
 - ▶ The patent examiner will often insist that a publication counts as “prior art”, negating your patent application, unless the co-author is listed as a co-inventor.
 - ▶ A collaborator who won't cooperate in a patent assignment can ruin any chances of licensing the patent.
- ▶ One founder I know, after many years in business, is careful of people visiting his premises. His company insists that visitors who're going to walk through sign proper non-disclosure agreements, which also clarify that they did not communicate any intellectual property to any of his staff while on the premises!

Some Observations on Electronic Systems Startups

- ▶ In many ways, a startup whose product is an electronic system, is a value-added reseller. The electronic (or optoelectronic) system will consist of off-the-shelf integrated circuit chips, lenses, lasers, etc., from other original equipment manufacturers (“OEMs”). These will be integrated together in electromechanical, electro-optical and printed-circuit-board assemblies, controlled by software running on some type of microprocessor or microcontroller.
- ▶ Thus the capitalization barrier to entry is relatively low if the founder and staff have a sufficient knowledge base. The value added usually takes the form of IP, inextricably interwoven with, and integrated into, the design, especially if it contains embedded software. A key part of IP in pcb design with high-frequency components is a design that ensures the system will not malfunction due to “cross-talk” and other unwanted signal interference among the copper traces on the pcb.
- ▶ Components such as waveguides for microwaves can be fabricated by a machine shop from the startup’s computer-aided design (“CAD”) files, such as Solidworks®. If the founder has sufficient knowledge, he needn’t use specialized radiofrequency (“RF”) software in the design of early iterations, but can use more generalized number-crunching software such as MATLAB and Simulink.

Some Observations on Electronic Systems Startups (2nd slide)

- ▶ CAD software for printed circuit boards, such as Mentor Graphics and Cadence, are affordable. The startup can send its CAD files to a pcb fabrication house which will fabricate the pcb and populate it with components (resistors, capacitors, chips, etc.). Such fully assembled boards, in small quantities, can get back to the designer in 48 to 72 hours. Arrangements can be made for contract manufacture of production quantities.
- ▶ In my case I got started in product development thru software simulations connected with consulting tasks. Continual use of the software grew from there to product development with actual hardware.
- ▶ Design software is an effort multiplier. In the hands of a good engineer, software tools can at least double a person's output, albeit after some downtime due to learning. Actually, the learning downtime can be minimized, and the learning curve made less steep, by learning to use only just enough capability to accomplish the task-step at hand.
- ▶ Always buy (or subscribe to) good software tools before looking to hire new engineers. A software tool is pretty much another engineer.
- ▶ A software tool is a capital expense, and must be depreciated over 3 years. But the full cost of a subscription is an expense in the tax year it was purchased.

Some Observations on Electronic Systems Startups (3rd slide)

- ▶ Outfitting an entire lab with RF and electro-optical instruments can cost the equivalent of a house (even with used equipment).
- ▶ Instead, rent some of your lab instruments for short periods. They will often sit there unused for part of the time anyway, because the person(s) using them will also have other tasks that don't require them.
- ▶ As with software, a purchased hardware instrument is a capital expense, and must be depreciated over a number of years. But the full cost of a rental is an expense in the tax year it was rented.

I hope this was helpful.
Thank you for listening!

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