

Getting what you want

First published in *The EMC Journal*, Issue 77, July 2008, www.theemcjournal.com

This is the 'pilot' for what I hope will become a series of short self-contained articles generally relating to design engineering and project management, with implications for EMC and safety engineering.

A problem faced by all engineers and engineering managers is persuading your boss that you need a new item of test equipment, or you need to add something to a product that is not in its technical specification (for example to reduce financial risks such as high levels of warranty returns).

You have the best interests of your company at heart, and you know what is needed, but you are a technical person and your boss probably is not. Your boss sees the costs, but the only way you can describe the benefits is by using technical language that your boss does not understand.

Worse, your boss may believe that your use of technical language is an attempt to 'blind him/her with science' and, resenting this, be more likely to refuse your perfectly valid request out of hand.

Your boss needs a justification that uses financial language – often so that he/she can then use the same arguments to persuade the bean counters (otherwise known as accountants) that run all engineering companies. *But you have to be the one that does it.*

Make no mistake, modern electronics and other engineering is all about the money, and if you want your company to be successful you must learn to deal with it successfully.

But a scientific or engineering education often contains very little, if anything, about how to communicate with financial people. This is, of course, stupid – because scientists and engineers who cannot communicate effectively with their bosses are not very effective.

The problems caused by this language barrier almost always come up during my training courses on EMC design. All my training is aimed at helping engineering-based organisations become more successful financially, but where additional investment is needed to help create financial success the engineers attending the courses usually say that it will not be permitted by their bean counters.

What they really mean, of course, is that they are unable to communicate effectively with their bosses. My resulting digressions from the planned training course material, into how to overcome this common problem, are often mentioned in the course feedback forms as one of the most useful parts of the courses!

Except in the simplest cases, there is *no way* that your boss is going to learn enough about what you do to understand why investing cash resources in that test gear, or design modification, is going to benefit the company financially.

Engineers must learn to present their arguments in financial terms. Sorry, but there it is.

Every engineer needs to be able to describe their company investment needs in terms that their Financial Director (or Financial Vice-President) can understand. The FD (or F-Veeep) is really the person who runs the whole company, but usually knows almost nothing at all about what their company actually does or how they do it. As far as understanding the boffins in the Engineering Department, they might as well be Martians.

Since I learned how to justify expenditure on engineering, about 20 years ago, I have not had a single capital application, design change request, or request for additional personnel turned down, ever.

The trick, as I eventually learned, is to do your homework thoroughly, taking into account all foreseeable effects on all departments of the company, present all requests in financial terms, and show how the investment will pay back sufficiently well, and in a timely enough manner.

A typical proposal would be a document with the first (cover) page being a one-page 'Executive Summary' that is purely for getting attention, followed by detailed Appendices.

You only have about 10 to 20 seconds to get your message across to your boss. This means that your one-page Executive Summary cover page should be written in 12 point Arial or an approved 'house style' font, with 1.5 line spacing, 24 point paragraph spacing, and margins of at least 30mm. Use bold, italic, or larger fonts for titles and emphasis.

These rules do not allow many words, which is fine because they should all be able to be read within 10 to 20 seconds (aim for 10). No sentence should occupy more than one line of text. No paragraph should have more than three sentences. **DO NOT TYPE USING ALL CAPITALS** – it's as if you are shouting.

The next important thing to know is that all financial people are gamblers. Why should anyone want to invest good money in an engineering company, when they could instead invest in supermarkets, oil, gas or steel manufacture, or property?

So your Executive Summary should be written accordingly. It must present the following financial information *in the order shown*:

- The financial benefits to your company
- The timescale over which the benefits will be realised (a simplified graph is often best)
- The probability of success (don't be shy, even a 50% chance of success is a good bet for a gambler)
- The total value of the investment required to achieve the above
- The timescale over which the investment will be required (e.g. a graph)
- Briefly say what the investment will be used for, using commonplace words

In all the above be direct and straightforward, don't try for literary merit, just get your basic message across without ambiguity. Once you have their attention, they can read all the details, and caveats, in the carefully argued appendix (10pt Arial, single line spacing, 6pt paragraph spacing, for example). But if you don't get them interested in the first 20 seconds, the appendices and all the work that went into them are wasted.

The final bullet point above might benefit from an example. Don't write: "0.1-26GHz four-port vector network analyser" – say instead: "Test equipment necessary for developing new high-tech products and improving production yields". The proper description and technical specification for the 4-port VNA will appear in the appendix.

The appendix is where you write up the detailed technical and financial investigations and calculations you have done. Always make sure to summarise everything in financial terms, and make sure to use discounted cash flow analysis (look it up) over the sales life of the product, at least. In the case of arguments based on reducing financial risk, for example from exposure to product liability lawsuits, the analysis should extend for at least 25 years. Some long-lived products, such as railway rolling stock, might need to use 50 years or more.

It is generally best to have an appendix with two sections:

- a) The first section amplifies the five basic items in the Executive Summary, using about one page each, so each of these is itself likely to be a summary. Avoid technical language as far as possible, because your boss is likely to read this section – if your Executive Summary crossed his noise threshold and got him interested.
- b) Your detailed calculations, using all the technical information you need. Your boss will almost certainly do no more than skim this to see how much effort you put into your proposal. But he or she will probably have it checked by an engineer they feel they can rely on, not necessarily one in your company, so it has to be correct!

Doing the homework means that you need to understand all areas of your company (design, development, manufacturing, marketing, sales, warranty repair, field service, etc.), how they do what they do, and what are the financial implications for them of what you are proposing.

You need to understand basic financial concepts as they relate to manufacturing companies, generally known as 'management accountancy'. These include: cash flow, discounted cash flow, investment, break-even point, return on investment, etc., plus of course the trendy jargon that inevitably attends them.

Engineers are often told there is no money available, whereas there almost always is – but only for proposals that are communicated effectively and appear to be a very good bet.

For example, in 2001 a UK manufacturer spent £100,000 redesigning their range of products to comply with the new versions of the EMC immunity test standards. These new versions introduced testing for a range of surges, dips and dropouts in the mains power supply, amongst other things.

The manufacturer would not have bothered with the redesign, had it not been for the fact that it was necessary for compliance with the EMC Directive, and they were a law-abiding company. But they subsequently found to their complete surprise that their new designs saved them £2.7 million in warranty costs *per year*. I have heard many similar stories over the years.

Imagine that in 1999 you were a senior engineer with that company, and had spotted the fact that the design of your products was lacking in what you thought was necessary for real-life reliability.

If you went to your Financial Director and said: “Please give me £100,000 to improve the EMC of our products, because I think they should be made immune to power line surges”. You expect the FD to give you the £100k because you are employed as a senior engineer and so of course you know what you were talking about – but you would almost certainly be disappointed.

Now imagine the same scenario, but this time you took the trouble to find out if it was a real financial problem – and you found that about £2.7 million of warranty costs per year could be attributed to surge damage that could be prevented by redesign.

If you then went to your FD and said: “I can achieve £2.7 million per year savings in warranty costs from next year, if you give me £100,000 for design changes and EMC testing right now”, and provided the detailed data and calculation in a document – then you would almost certainly get the £100k and a pat on the back, almost regardless of the financial situation the company is in.

You don't need a Degree in Business Management to do all this, just ‘Management Accountancy for Dummies’ (if there isn't a book with that title, there should be), common sense and a grounding in reality. You can know enough to amaze your bosses that a mere engineer should be so knowledgeable about company finance, yet still find the financial pages of quality newspapers almost completely baffling.

Good engineers are all very clever and grounded in reality, so learning the above stuff well enough is easy for them. If it all sounds like extra – it is – but the rewards are worth it.

It is just another learning curve, and engineers are good at learning, because they have to be just to keep up with technology. This business and financial stuff is different, for example you can't calculate it to five digits (well, you can, but only the first digit means anything) so you have to learn to be comfortable with fuzzier data and larger uncertainties.

Having all this business and financial stuff under your belt and at last effectively communicating engineering needs to bosses (and bosses' needs to engineers), makes your company much more successful, and leads to pay rises and promotion.

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