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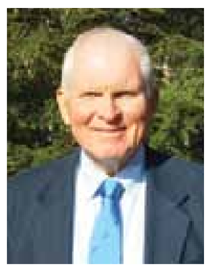
Balancing Innovation with Design Rigor and Processes

Tom Perkins
Senior Technical Editor



I have enjoyed the privilege of being involved in design and development projects—mostly RF and microwave hardware--at many levels spanning parts of six decades. Responsibilities range from bottom-up design to leading teams of engineers and technicians. In recent years my involvement has, in part, reverted to serving as an individual contributor, which can be very rewarding. This led to several patents awards late in my career.

Most projects carry very specific specifications and very short, defined schedules, requiring examination of the "critical path" schedule. Schedule slippage almost always leads to higher spending and cost overruns. Furthermore, in today's economy, design entities must be responsible to a "customer" at a higher level up the "food chain." The customer usually has rigid, unwavering expectations and specifications which may have been created by engineers who never get to meet the ultimate supplier/contractor.

After specifications are created, legalism over the way specifications are written can be an issue. Both specifiers and suppliers now ponder the meaning of "will," "shall," "must," "meet," "goal," "figure of merit," "nominal," etc. This occurs more in today's environment due to lack of sustaining funds for the user to support the supplier design activity and profit-driven "bottom line."

R&D Handcuffed

It seems that research and development is mostly relegated to universities, a few other government funded entities, and occasionally, efforts by individuals in home garages or basements, e.g., the Varian brothers and Hewlett-Packard. The development of electronic integrated circuits (and no doubt many regulations controlling business activity) has lessened the ability to do the gutsy garage-type activity over the past 40 years because of the need for specialty assembly capabilities. Many projects these days seem to expect outcomes that are truly unique and innovative, but carry limited funding and tight schedules—as if the design process and outcome is entirely predictable.

What to Do?

So given this background, engineers' drive for innovation can be significantly curtailed by the "bottom line" finances available. Obtaining parts for experimentation in practically zero time can require very resourceful effort because the rigid systems in place for parts procurement too often have been established primarily for production and "just-in-time" receipt. One partial solution is obtaining "samples," but these are sometimes unreliable parts—and a single failure can result in quick dismissal of a project by management. Rigorous design rules, such as parts derating, design reviews (Preliminary Design Reviews, Critical Design Reviews, and Final Design Reviews) and many "-ilities" are important. But with tight constraints on schedules and finances they often severely limit time for experimentation.

Suggestions:

- Make a list of solutions very early in the design process. This would certainly include the solution proposed, but might have variants that could be more or less innovative, and might save cost.
- Most design efforts involve team effort and the ability to compromise, combined with the resolve to do right. Sometimes you can get your wishes met by just 'floating' an idea and letting others scramble to take credit for it.
- Keep the design as simple as possible.
- Try to anticipate how the design will look when released to production. Will it survive the test of time going forward with minimal Engineering Change Orders and compromises?
- Will it fill a requirement that could be adapted to some future upgrade with minimal interface changes? Can we fill this space with something better in the future?
- Discuss your ideas with others in various disciplines outside of engineering to get their inputs: project management, QA, reliability, manufacturing, etc.
- Make the first meeting with the customer exciting by showing solutions considered and even making "mock-ups" of what the product might look like. Make sure the customer understands your interpretation of what they want. Sometimes there is wide difference between the written word and what they really need. Get changes in writing!
- Be practical about where parts can be obtained. Try to insure that sample parts are reasonably reliable and not counterfeit, or rejects.

Finally: remember that not all projects will be overwhelmingly successful. Some are praiseworthy but flawed concepts while others may be inadequately funded. But while you cannot be responsible for everything that happens, never let distractions interfere with your next good idea.