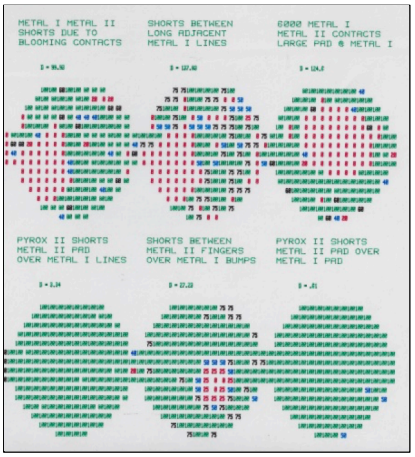
Experience with Semiconductor Technology Development Potentially Relevant to LENR

#S. Dana Seccombe[1]
[1] Tactyx, USA
Email: seccombe@alum.mit.edu

The author had the experience of developing an advanced integrated circuit technology, and a computer system based on the technology. Some of the lessons learned there might be applicable in accelerating commercial realization of LENR, despite significant technology differences.

Between 1978 and 1982, a team of 15 Hewlett Packard process development engineers and 30 VLSI design engineers worked in Ft. Collins CO. They developed and put into production a 1 micron, double-level tungsten-metal integrated circuit technology that was 50 times denser and five times faster than competitors In parallel, the group developed a computer system based on that technology [1]. The system included six chip designs with up to 600K transistors per chip. The technology won best paper awards two years in a row at the International Solid State Circuit Conference, the premier conference on solid-state circuits and systems [2].

The project was much more than just a research effort, being also the basis for 2000 people's livelihood. In addition, it produced a rapid methodology in solving the many, mostly unplanned and somewhat subtle problems. A useful set of tools and paradigms emerged which greatly accelerated problem resolution. Some of these tools were not initially obvious to the R&D focussed team.



Six of approximately 150 vital parameters shown. Failing regions shown in red. Goal: 150 maps all green, achieved.

Fifteen lessons learned for yield improvement included these:

- Small teams can deliver dramatic results, if they *stay* focussed.
- Cycle time through experiments is directly related to convergence rate on solutions to problems.
- Unit process control, and both cradle-to-grave and chemical tracking are essential.
- Easy-to-use, comprehensive, automatic diagnostic tools and special test structures greatly simplify otherwise difficult problems.
- Intermediate gains are important to maintain team morale and funding for continuing development.

Yield in semiconductor production is conceptually equivalent to success (reproducibility) in LENR experiments. We believe that some of the lessons learned in semiconductor technology development may be germane to research and commercialization of LENR. If funding of LENR development were adequate, it would be possible to use the iterative, focused practices from the massive semiconductor industry to speed knowledge, commercialization and exploitation of LENR.

Materials are central to LENR, as they are in the semiconductor industry. Systematic parameter variation experiments with diverse materials, using robust experimental setups with multiple monitors and serious data analysis, would require team efforts and significant funding. But, they have the potential to bring LENR to market sooner and with greater confidence, compared to the current diverse, and usually-disconnected and widely-distributed, experimental efforts in the field.

[1] *www.hpl.hp.com/hpjournal/pdfs/IssuePDFs/1983-08.pdf*.
[2] Jim Mikkelson, Lawrence Hall, Arun Malhotra, S Dana Seccombe and Martin Wilson, "An NMOS Process for fabrication of a 32b CPU chip", IEEE International Solid State Circuit Conference, New York City, Vol. 24, pp.106-107, 1981