

## m\_beach\_project\_list\_OCT08

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Primarily an electrical engineer, I am often involved in aspects of overall system design, integration, and debug that include optics, lasers, heat flow, and mechanical tolerances.

### SKILLS

- Multi-disciplinary engineer, project manager, liaison between scientist, engineers, and manufacturing, with 20+ years of experience
- Precision instrument design and development
- Low noise analog design, at both circuit board and system level
- High voltage design
- Electro mechanical system design
- Servo systems (PID, classical control theory)
- Lasers, optics, sensors, in particular the following:
  - Light sensing using: photo multiplier tubes, photo diodes, APDs
  - Distance and rotary motion sensing using capacitance sensors, rotary digital encoders
  - Phase locked loop, modulation schemes (pulse position, FM, FSK, etc)
  - Test equipment using LabView and motion control I/O card
  - VHDL and other logic design capability, familiar with CPLD and FPGA designs and system level trade-offs

Some example projects are listed below:

#### MEMS Gas Sensor.

MEMS device used as a combination sensor and source for a novel NDIR gas sensor. Support electronics has required a careful attention to details of low-noise design, and systems approach.

#### ELECTRONIC "NOSE"

This prototype product is intended to "sniff" for landmines by sensing the volatile chemistry of the explosives. It uses fluorescent sensors that react to various chemicals. I was responsible for an improved re-design of the electronic "front-end" which included an improved more stable illumination source, low noise photo diode detectors, CPLD programming, new architecture for the A/D.

Links: <http://www.pbs.org/saf/1201/segments/1201-1.htm>

#### HIGH VOLTAGE RESONANT POWER SUPPLY

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This is used to ionize gases in a capacitor as part of an industrial chemical process. It operates near 25kHz, provides 1.5kW at 5kV peak to the reactive load. The reactive power is approx. 25KVAR. It achieves the voltage by resonance of the capacitor load with an inductive "transformer".

#### LASER SCANNING FLUORESCENT MICROSCOPE

This lab instrument is used for drug discovery, DNA research. I was responsible for the electronic system architecture, and for coordination of two software groups, one for the micro-controllers within the instrument and one for the host PC.

Low-noise system design was paramount to be able to detect low levels of light, using a photo-multiplier tube. A servo system controlled the line scanning of the slide, while a stepper motor controlled the page scanning, and both of these had to remain stable to accurately capture data pixels.

#### HANDHELD LASER SURGERY DEVICE

This camera sized device attached to a CO2 laser to allow plastic surgeons to perform skin ablation to remove age wrinkles.

We made two generations of this system. The design involved a special position feedback encoder, a special custom galvanometer design.

I was able to achieve field replace-able servo amplifiers for the system, something that had not been available with previous systems - previously, every galvanometer was shipped with a uniquely tuned servo.