

# Power Electronics at the University of British Columbia

Undergraduate and Research

# Faculty

- W G Dunford – Systems, photovoltaics, machines
- J Jatskevich – Systems, drives
- P Palmer – Device modeling, fuel cell systems.

Research	2003/04 external research funding: \$350 million <a href="#">more...</a>
Teaching	4,000 faculty members <a href="#">more...</a>
Students	UBC Vancouver: 35,000 undergrad, 8,000 grad UBC Okanagan: Opens Sep. 2005 with 3,900 students <a href="#">more...</a>
Tuition	\$4,011 (based on 30-credit program for domestic students) <a href="#">more...</a>
Campuses	Four Campuses: Vancouver, Okanagan, Robson Square, Great Northern Way <a href="#">more...</a>
Economic Impact and Knowledge Transfer	Annual revenue: \$1.13 billion (2004) Third-largest employer in BC with more than 10,000 direct jobs and 16,000 total jobs <a href="#">more...</a>
International Students	More than 4,000 international students from 120 countries <a href="#">more...</a>

# Local Industrial Collaborations

- Alpha Technologies (Argus)
- Xantrex
- General Hydrogen
- Powertech Labs

## Company Summary

Offices	Burnaby BC, Arlington WA, Livermore CA, Elkhart IN, Barcelona, London, Beijing
Manufacturing	Burnaby, Arlington, Dominican Republic, China (4 Outsourced Locations)
Employees	525
Revenue	US\$143 Million in 2004
Patents	38 with 68 more in progress
Ownership	Public, Toronto Stock Exchange (XTX)
Established	1983

# Mobile Power Product Portfolio



## Recreational Vehicles



**RS2000/MS2000**  
Inverter/Chargers



**Prosigne**  
Inverters &  
Inverter/Chargers



**Freedom Marine**  
Inverter/Chargers



**TrueCharge**  
Chargers



**Xantrex Battery**  
Chargers



## Commercial Vehicles



**Railmount**  
Inverter/Charger



**Fleetpower**  
Inverter/Chargers



**Prowatt**  
Inverters



**TrueCharge**  
Chargers



**Prosigne**  
Inverters &  
Inverter/Chargers



## Portable Power



**XPower**  
Powerpack 150



**XPower**  
Powerpack 400



**XPower Powerpack 300**



**Micro Inverters**



**XPower Plus Inverters**



**XPower Chargers**



**XPower Jumpchargers**

# Present WGD students

- PhD – Magnus Lind – Ferroresonant Analysis
- PhD – Weidong Xiao – Photovoltaic Conversion
- PhD – Kenneth Wicks – Switched Reluctance Motor
- MASc – Dave Majaess – Base Station Power Management
- MASc – Yan Li – Revolving Stage Control
- MASc – Yong Zhang – Distributed Generation
- MASc – Amir Rasuli – High Voltage Switch





Dept Elec & Comp Eng



# Fred Kaiser Atrium

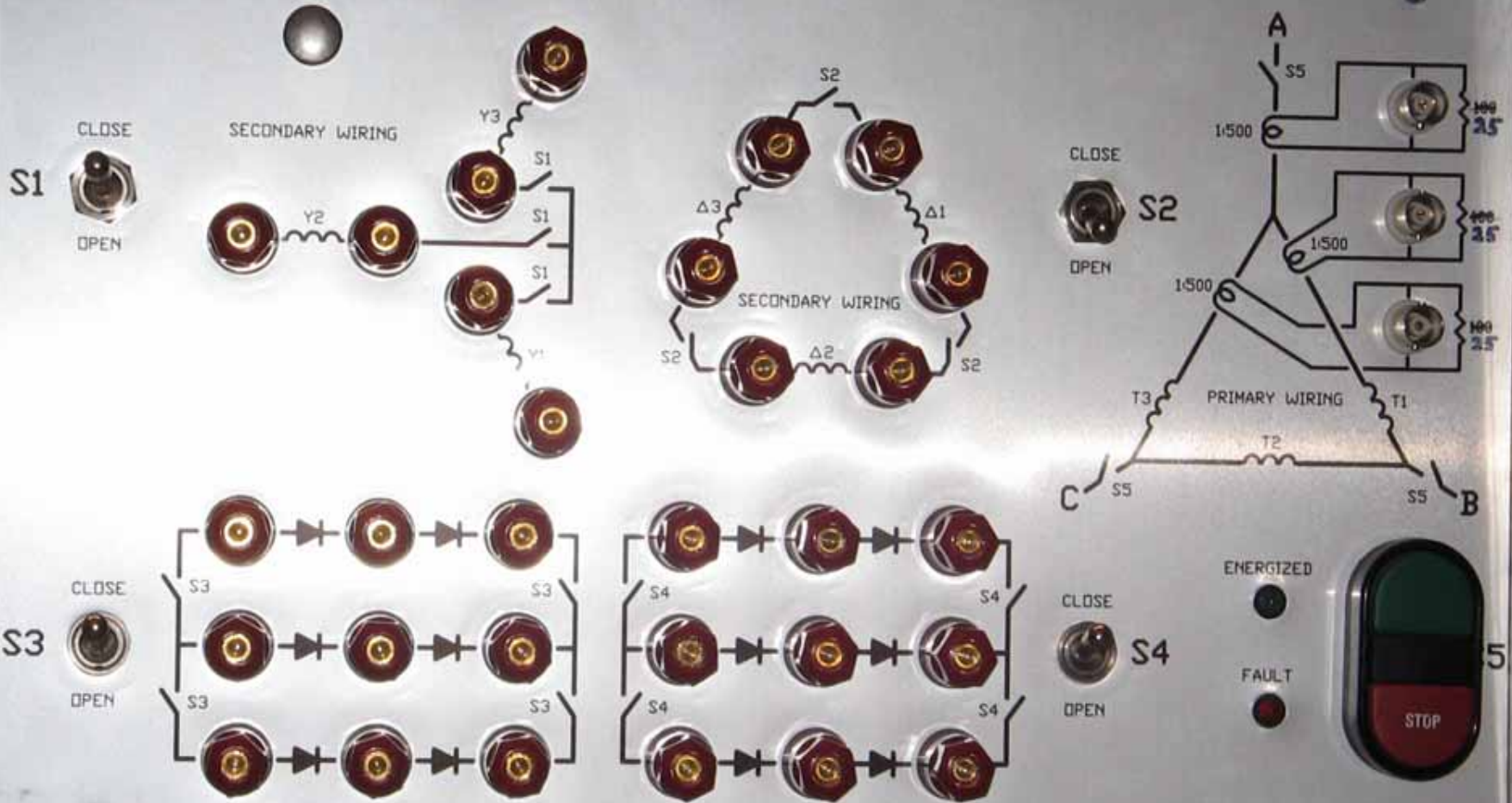


# Photovoltaic Facilities (old and new)



# Undergraduate Power Module

## 3 PHASE POWER SUPPLY



UBC Electrical & Computer Engineering





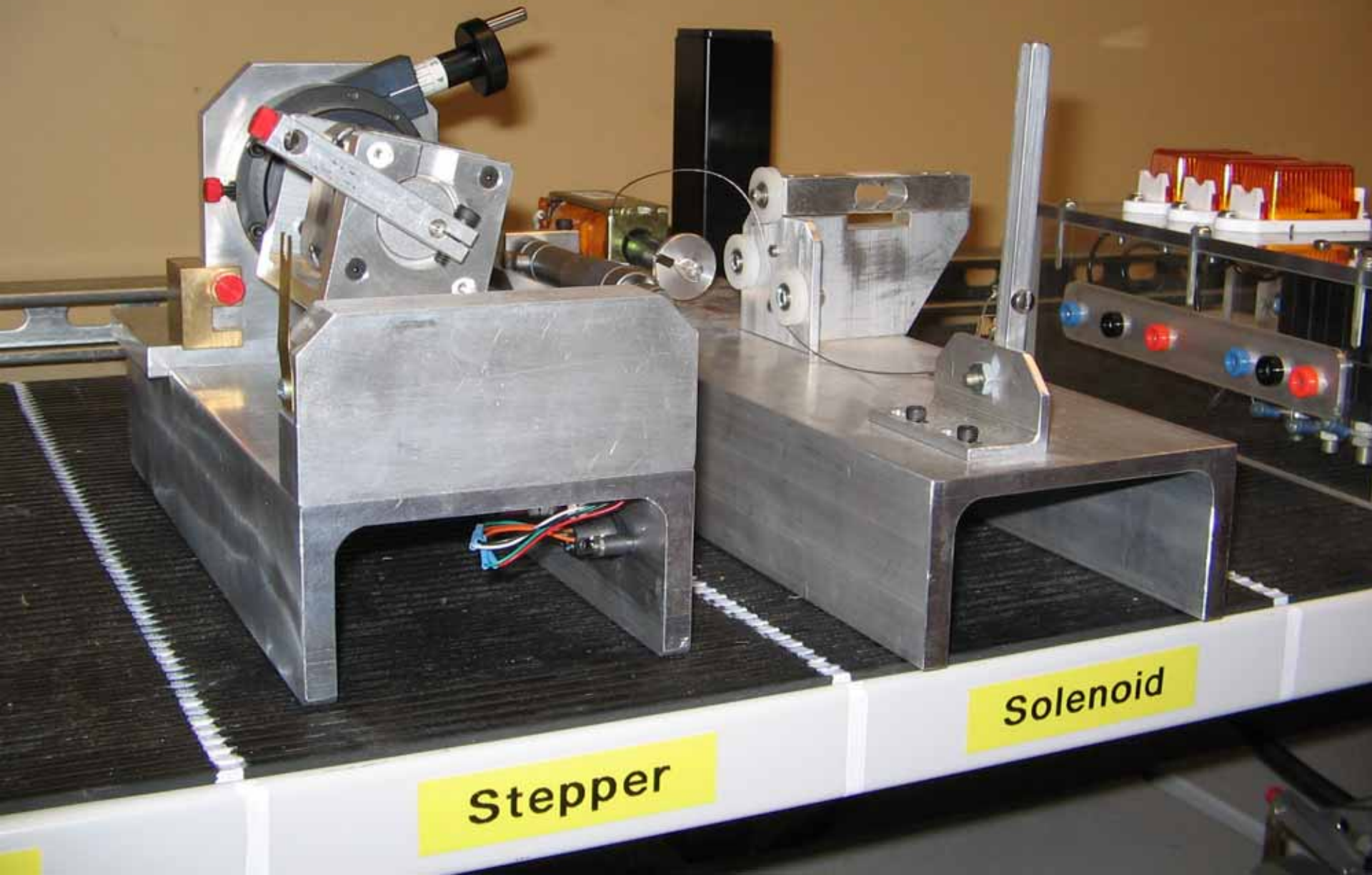
Typical Machine Set

# Instrumentation Interface Module





# Electromechanical Modules



**Stepper**

**Solenoid**



# Alpha Technologies Power Laboratory

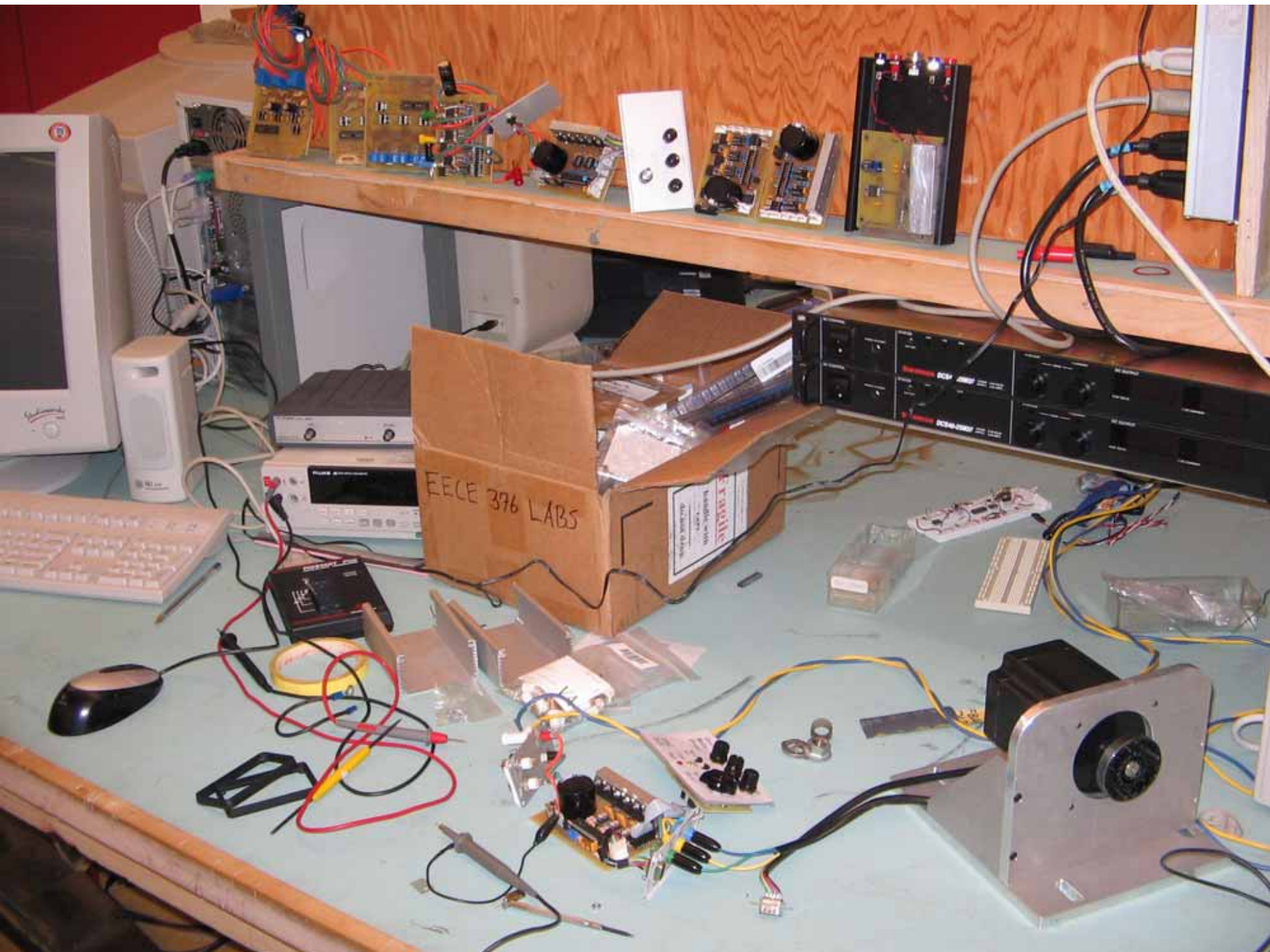
*generously supported by*  
The Kaiser Foundation for Higher Education



# Alpha Lab

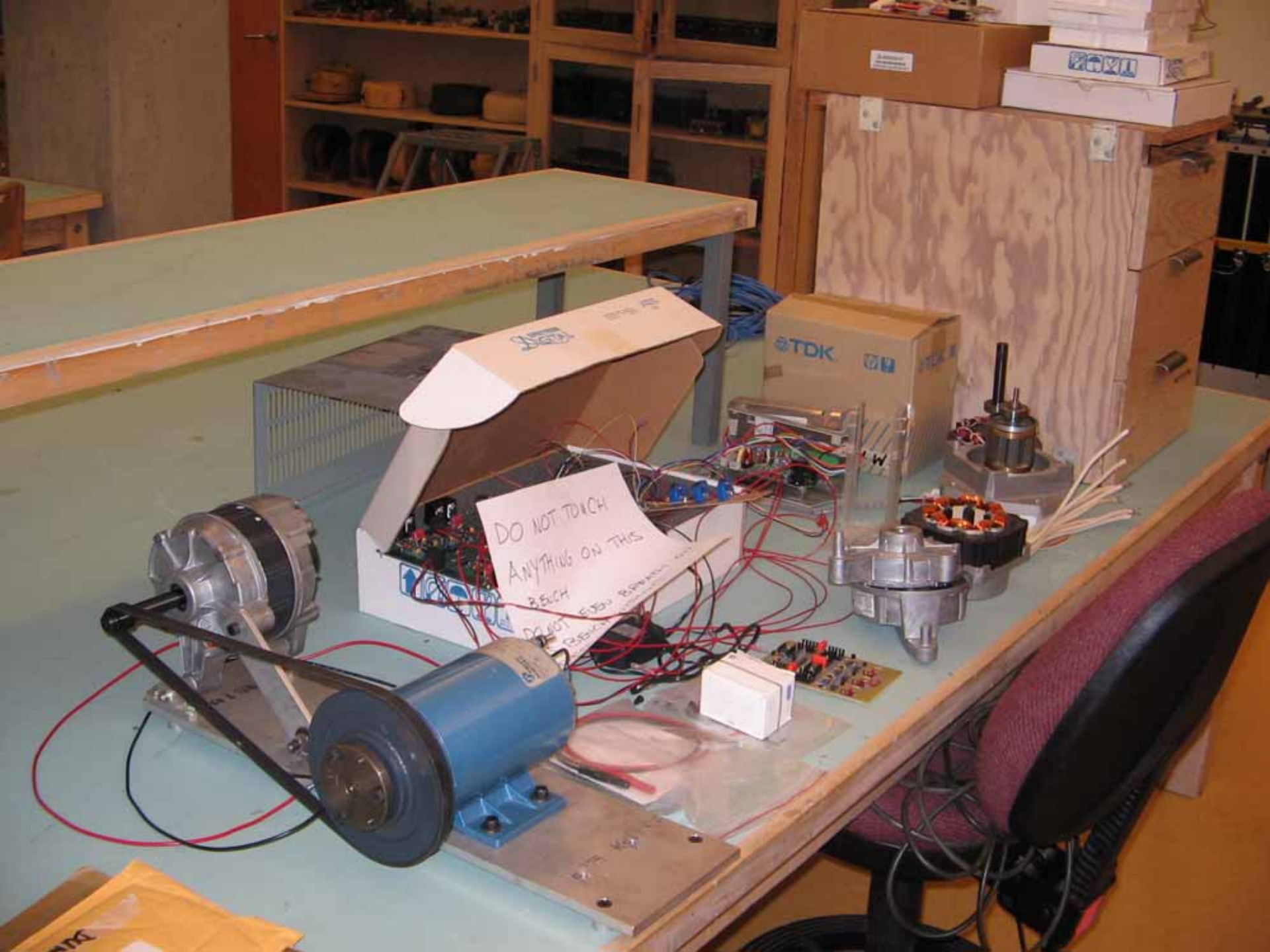






EECE 376 LABS

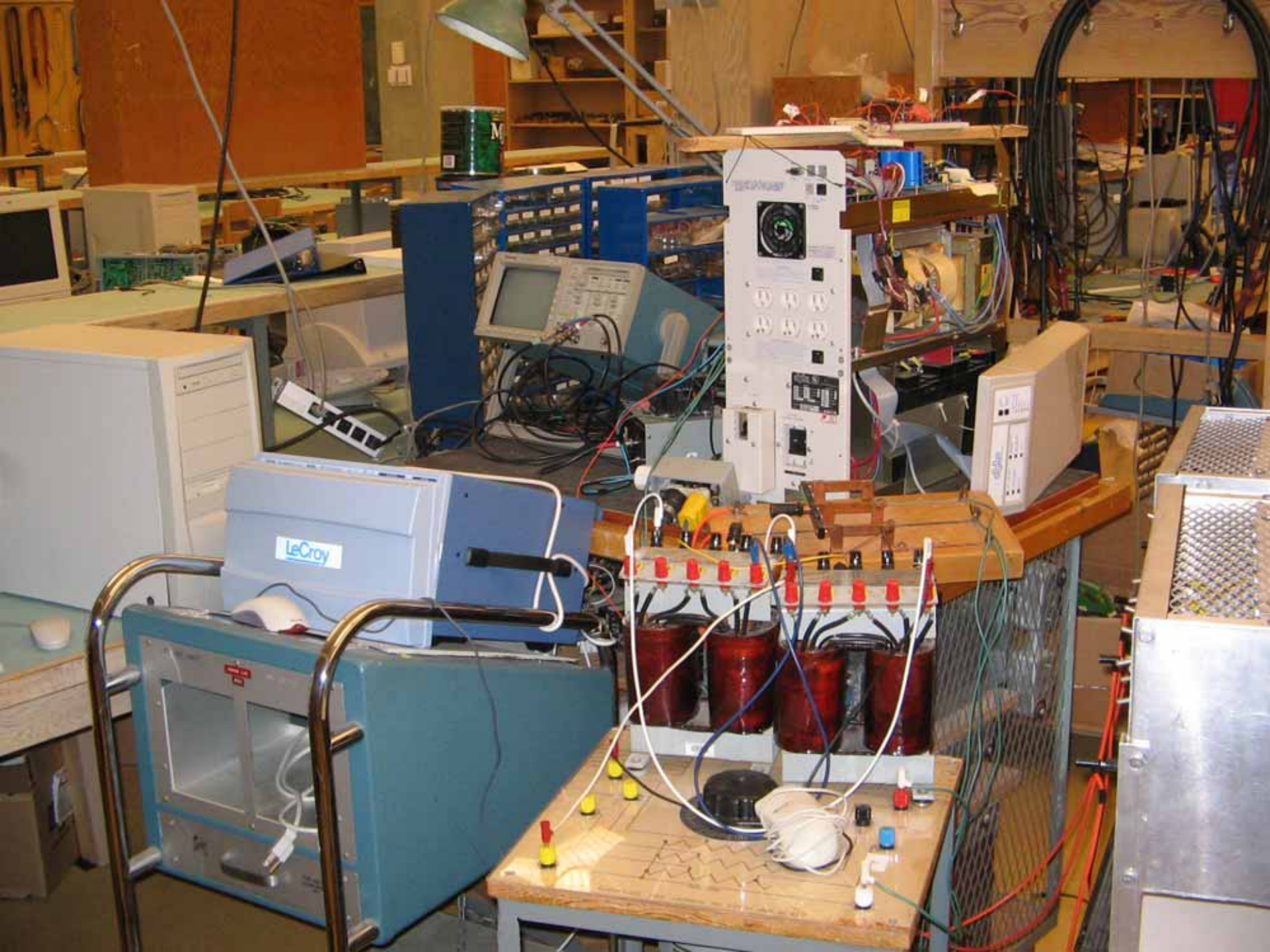




DO NOT TOUCH  
ANYTHING ON THIS  
BENCH

TDK



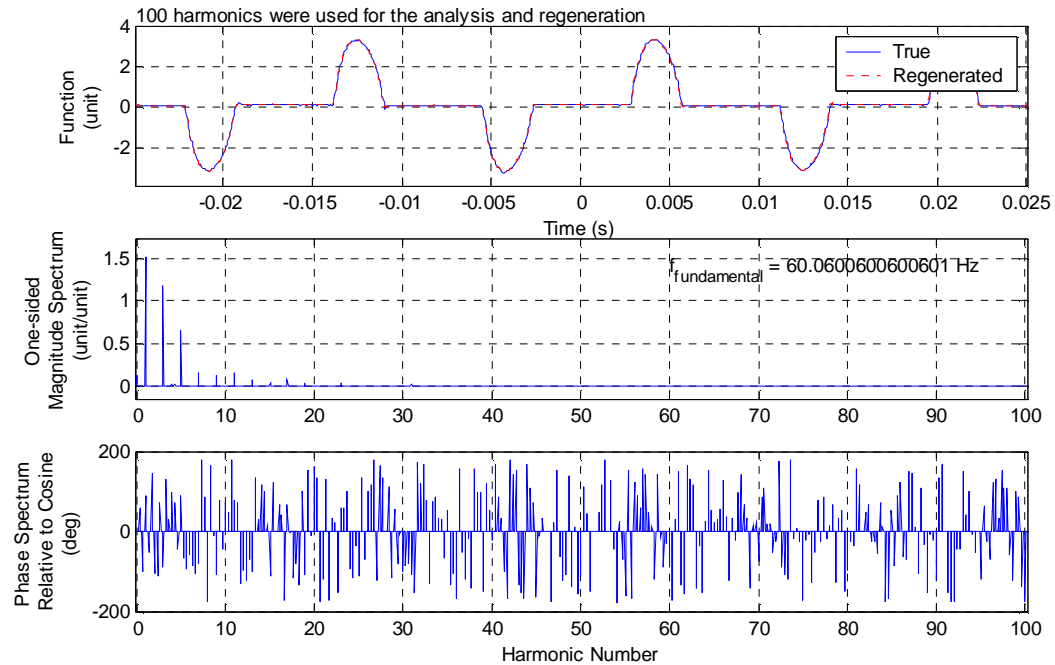


# Some Typical Loads

After 100 years of power  
electronics development.

Measurements thanks to Magnus Lind

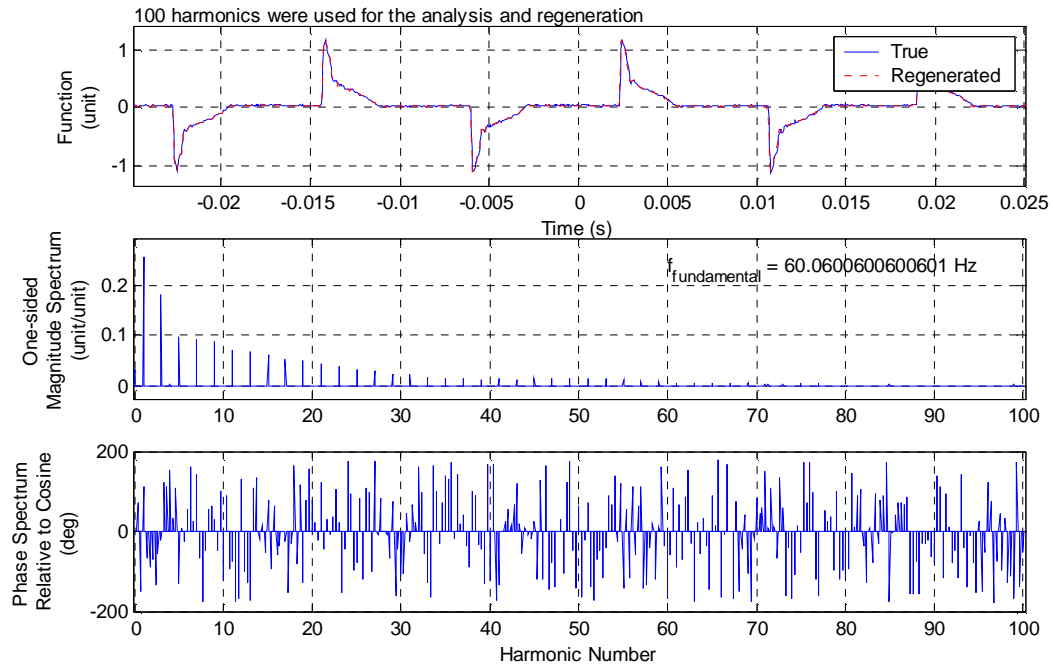
# Personal Computer



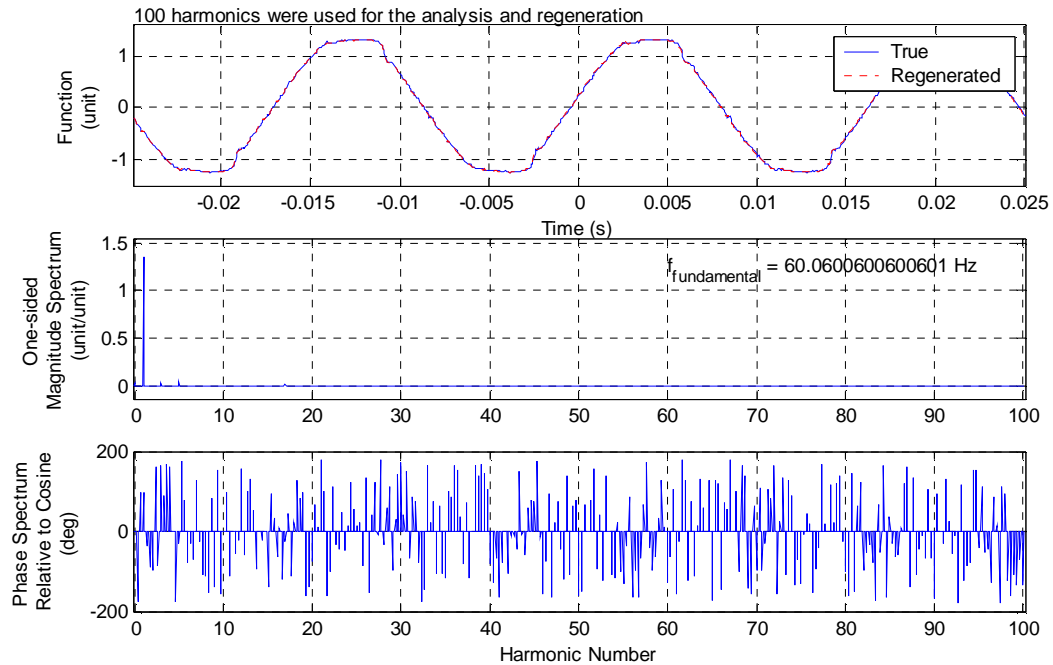




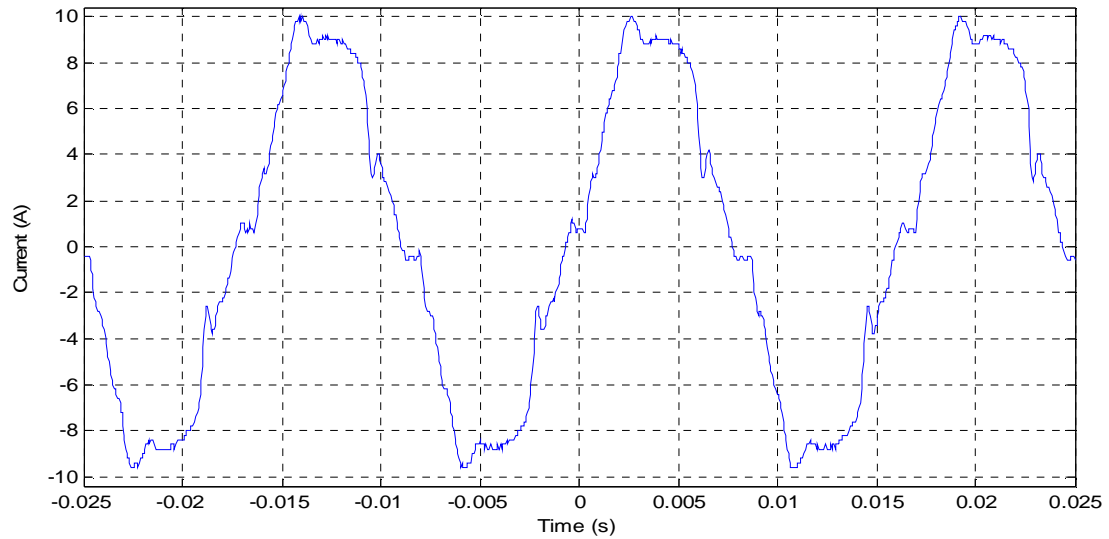
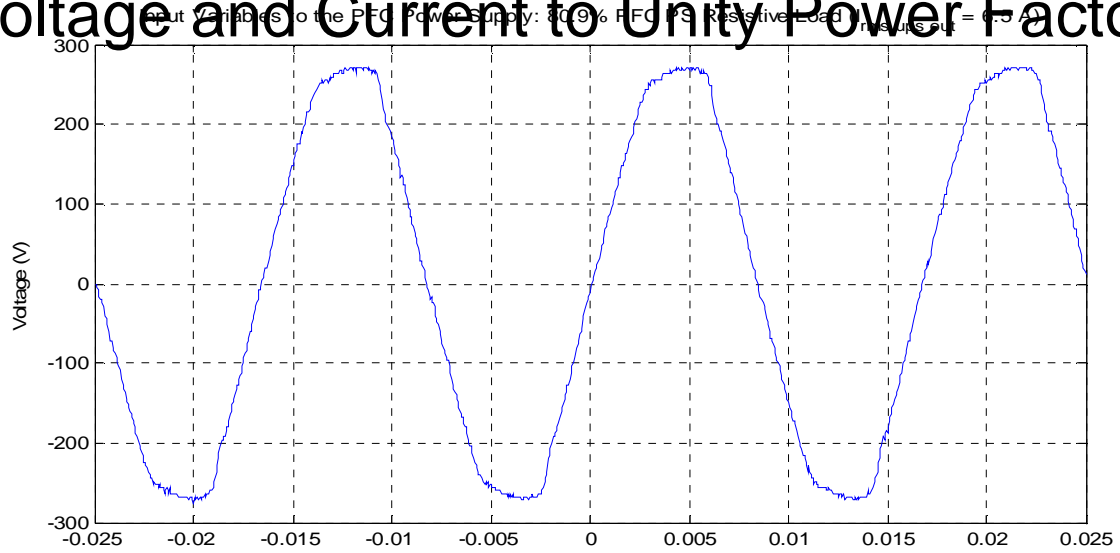
# Compact Fluorescent

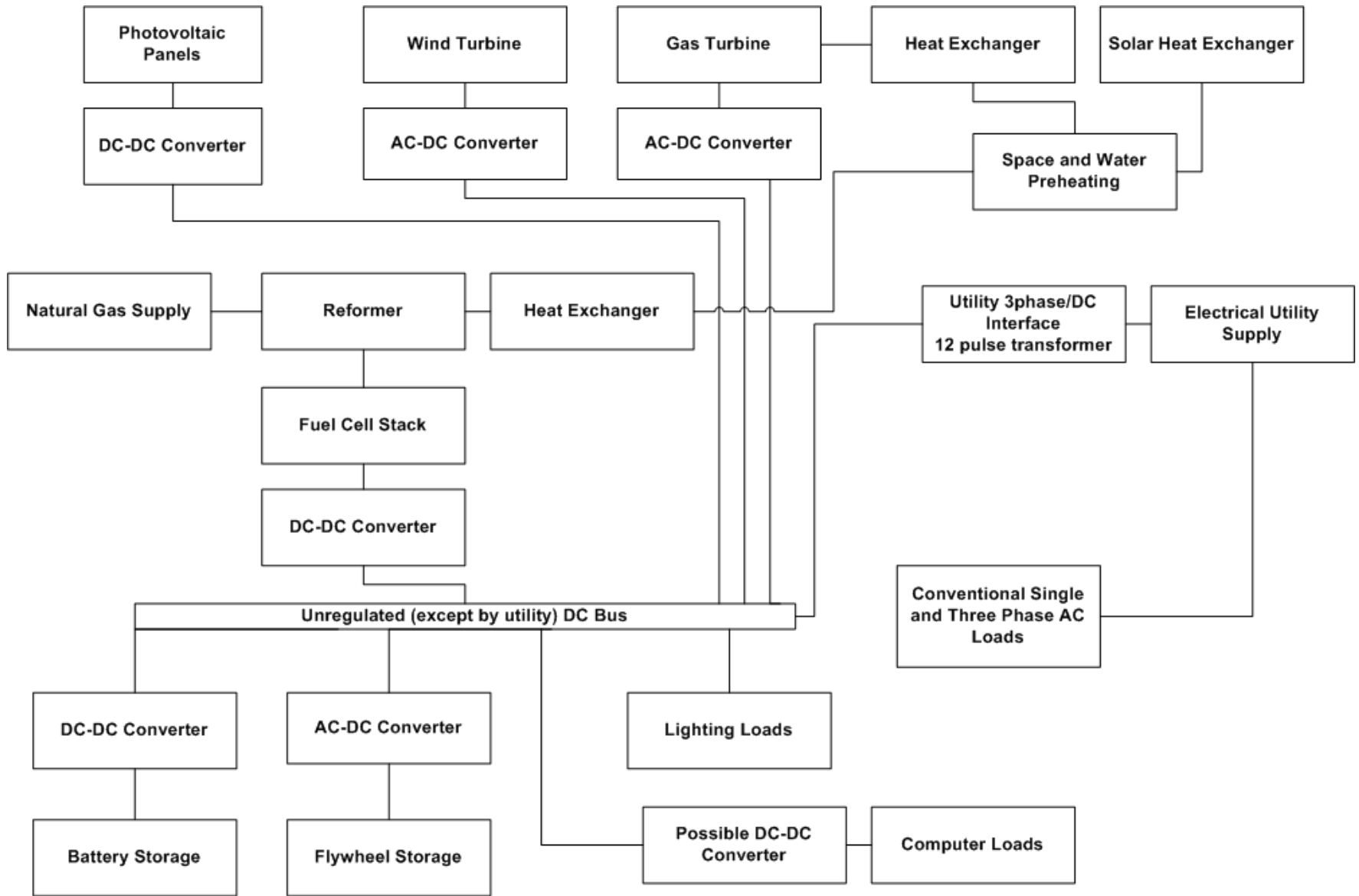


# Resistive Load



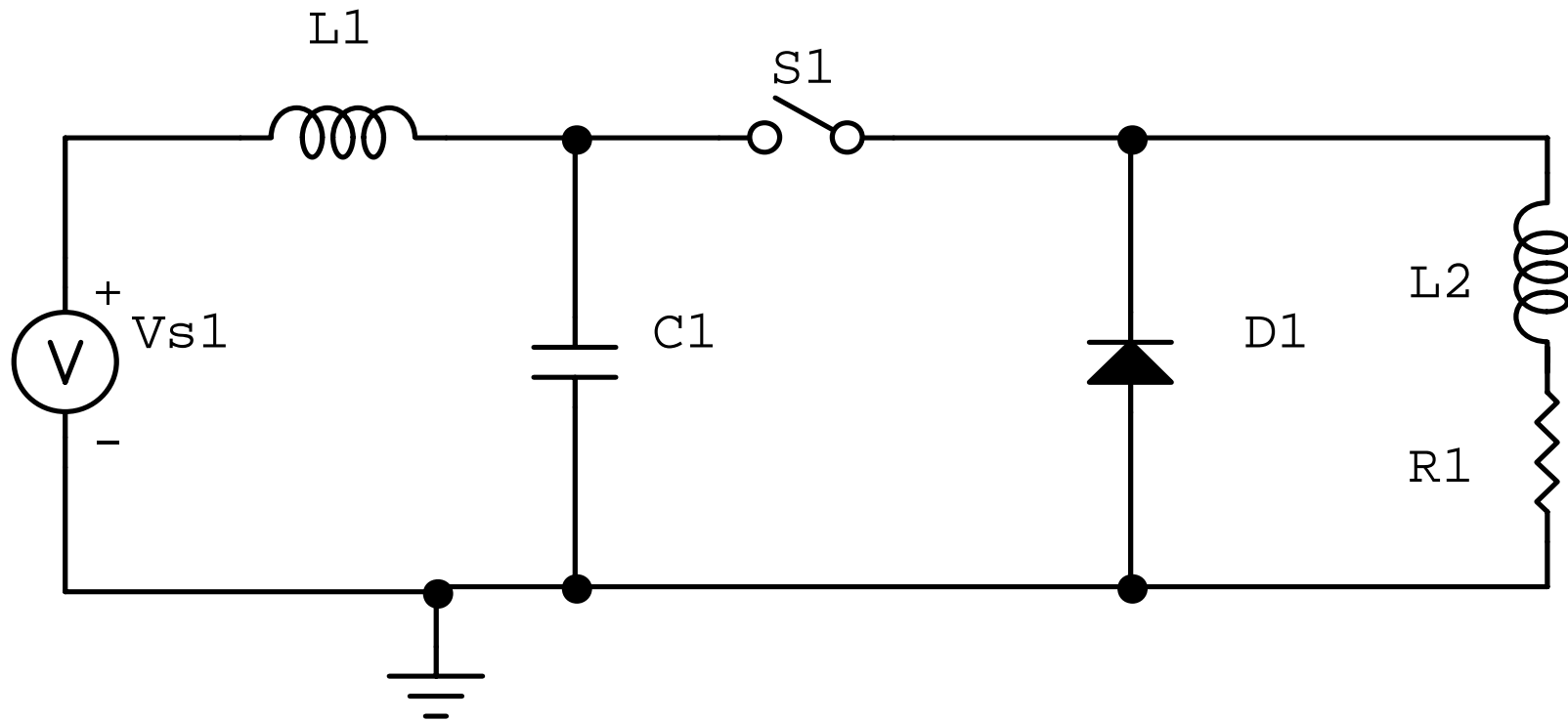
# Input Voltage and Current to Unity Power Factor Supply



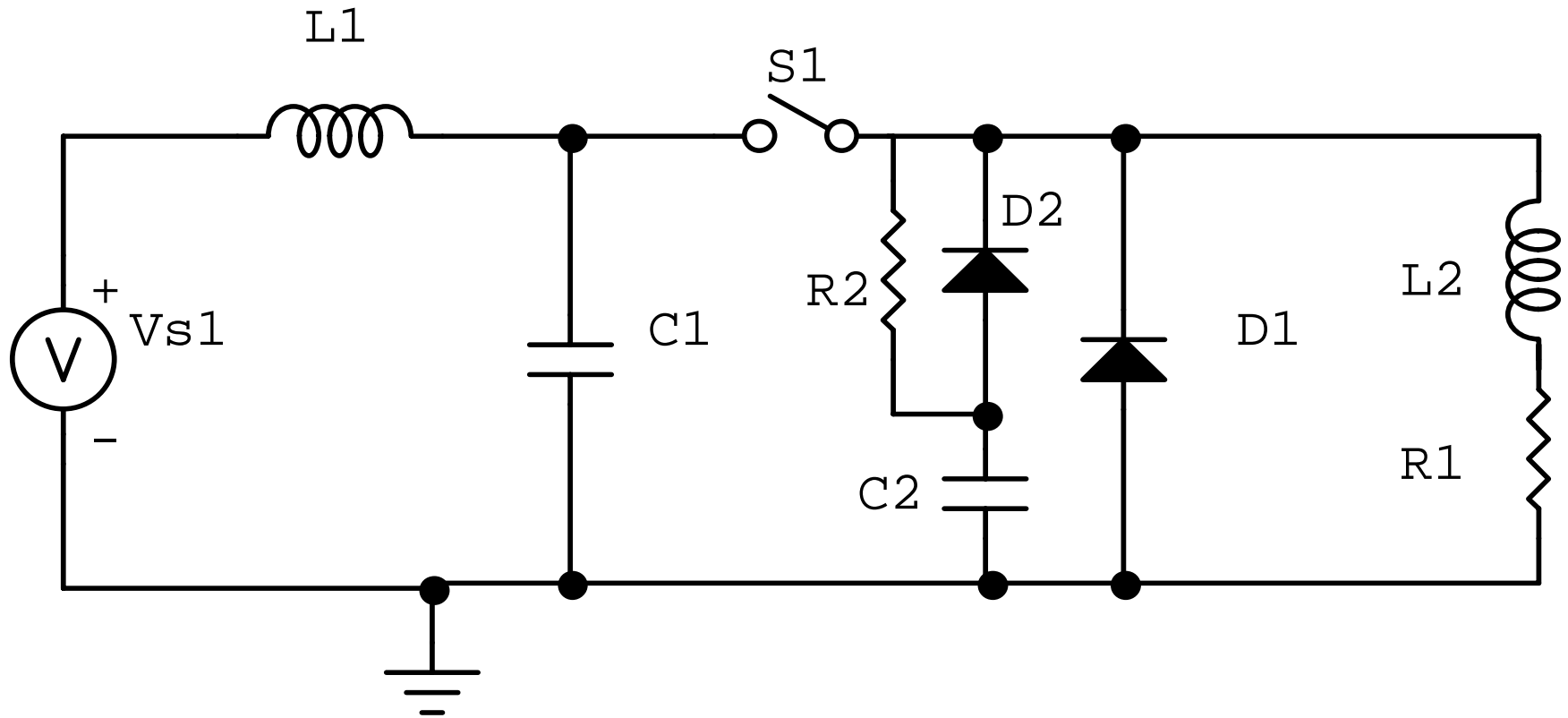


# Proposed Alternative Energy System

# Basic DC Switch Circuit



# Improved Switching Aid Circuit



# Sealion Implant Design



# Design Criteria



Photo: UBC Marine Mammal Research Unit

- Mortality, dispersion and foraging studies
- 3-yr life span
- Head position
- Biocompatible
- Polling rate ( $1 \text{ hr}^{-1}$ )
- $3 \times 6.5 \times 0.3\text{-}.6 \text{ cm}$
- Suitable range
- Base station env. restrictions
- Economical

# Many Prototypes: Developed and Tested

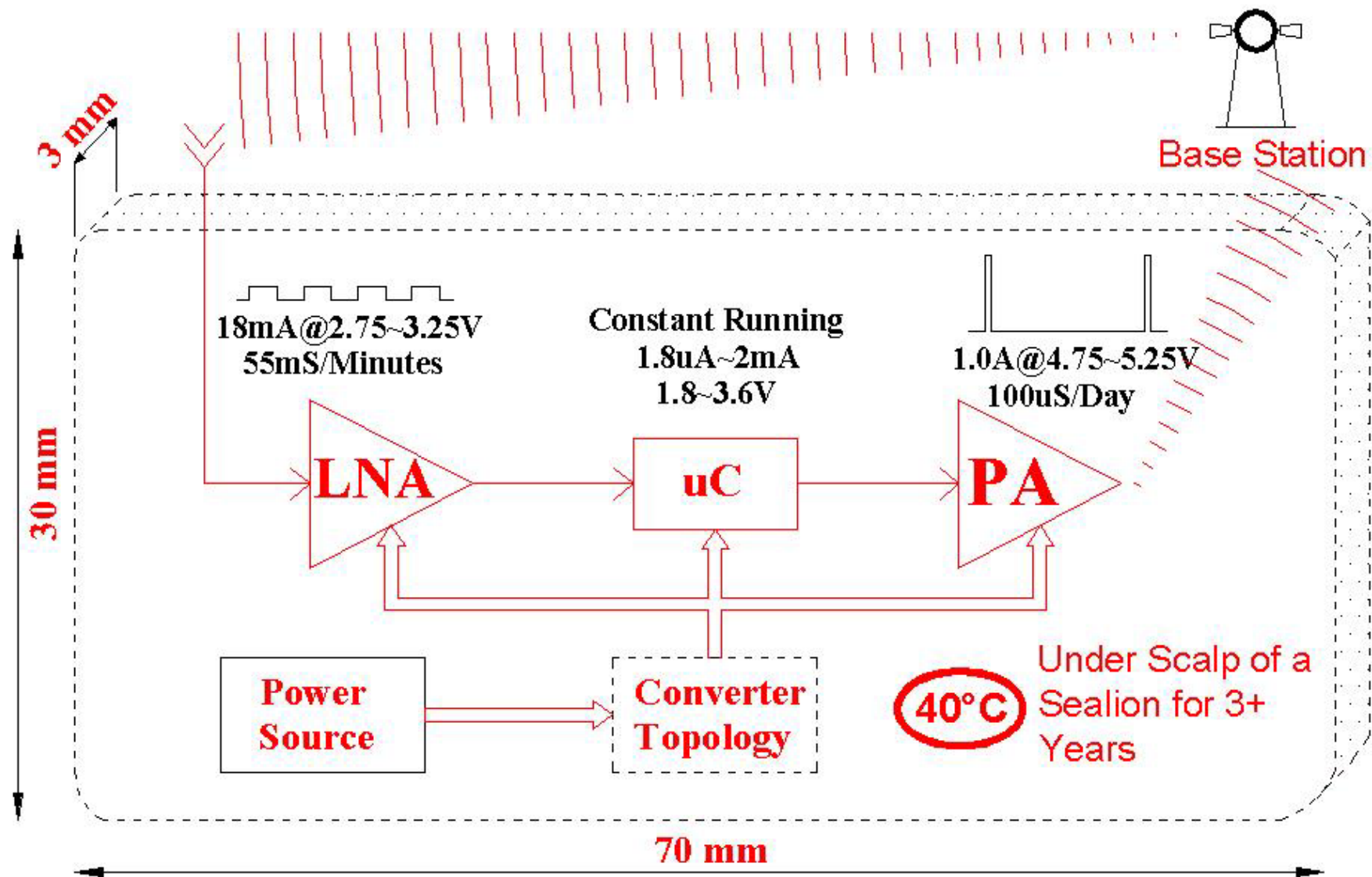
"Base Station"



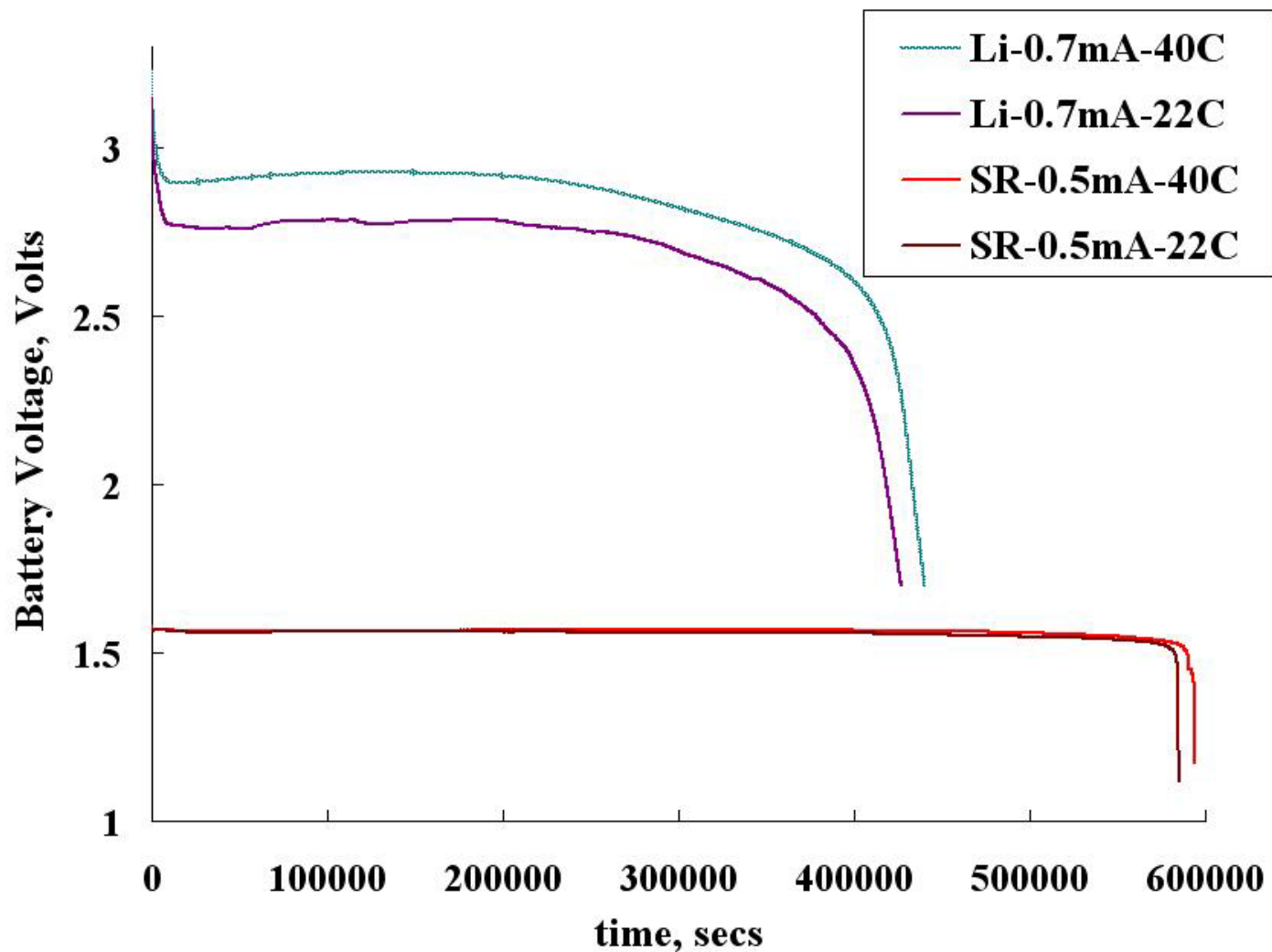
Battery Driven

External Power

- **Battery Management**
  - Capacitor Bank
  - Switches
- **IC Communications**
- **PC Communications**
- **Peripherals**
  - Thermistor: mortality
  - Memory
- **Antenna Trials**
  - 850 meters 10dBm



# Typical measured discharge curves





# Base station placement: land or sea?



Can you  
poll my  
pup on  
the beach  
too?