TACOM

Lethality, Survivability, Mobility and Sustainment for America's Army

ELECTRONIC DESIGN FOR XM784/XM785 MORTAR TIME FUZE

PRESENTED TO THE NDIA FUZE SYMPOSIUM

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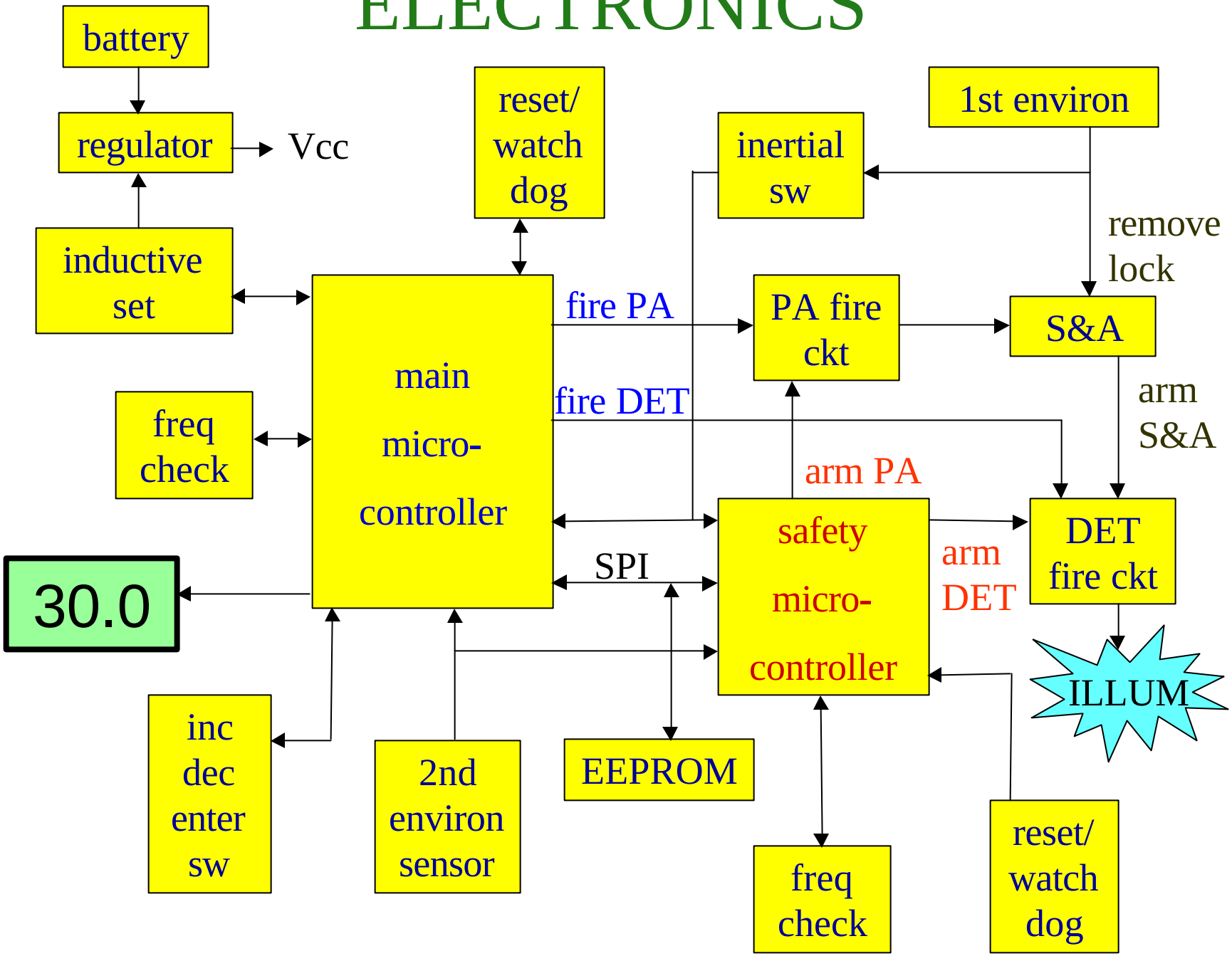
INTRODUCTION TO IN-HOUSE EFFORT

- Electronic design
- Schematic
- Breadboard
- PWB
- Software
- Battery
- LCD
- 2nd environment

MORTAR TIME FUZE

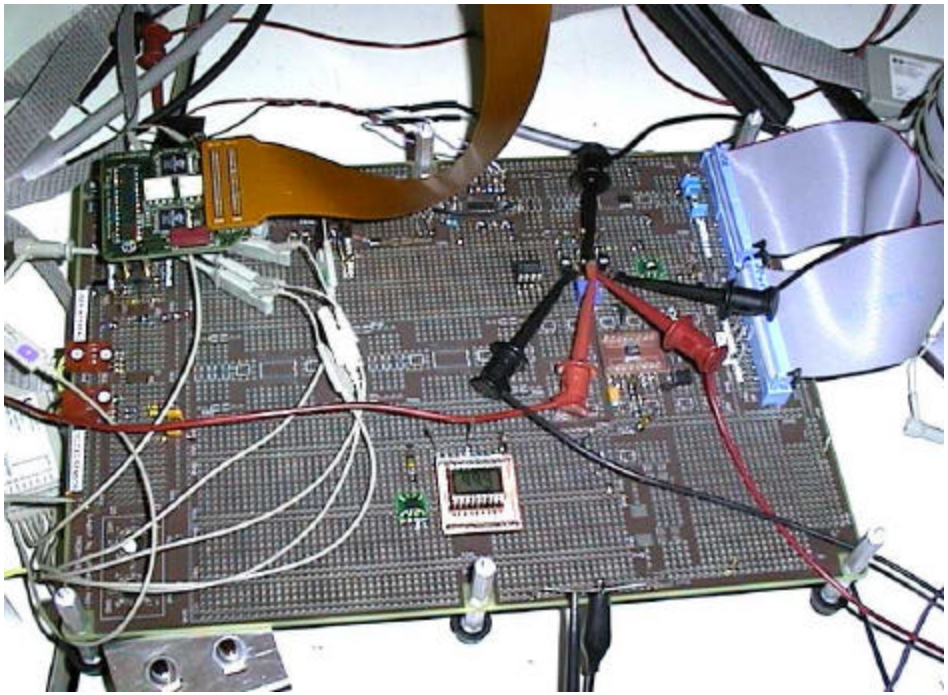
- Hand-settable
  - ogive inc/dec switch
  - enter switch
  - backlight LCD
- 5 - 99.9 ± 0.1 sec
- Dual micros
- Dual XTAL timebases
- EEPROM data recorder
- Built in test (BIT)
- Dual watchdog timers
- 30 day battery life
- Sleep mode
- Inductive set
- EOD batt discharge
- PD backup

ELECTRONICS

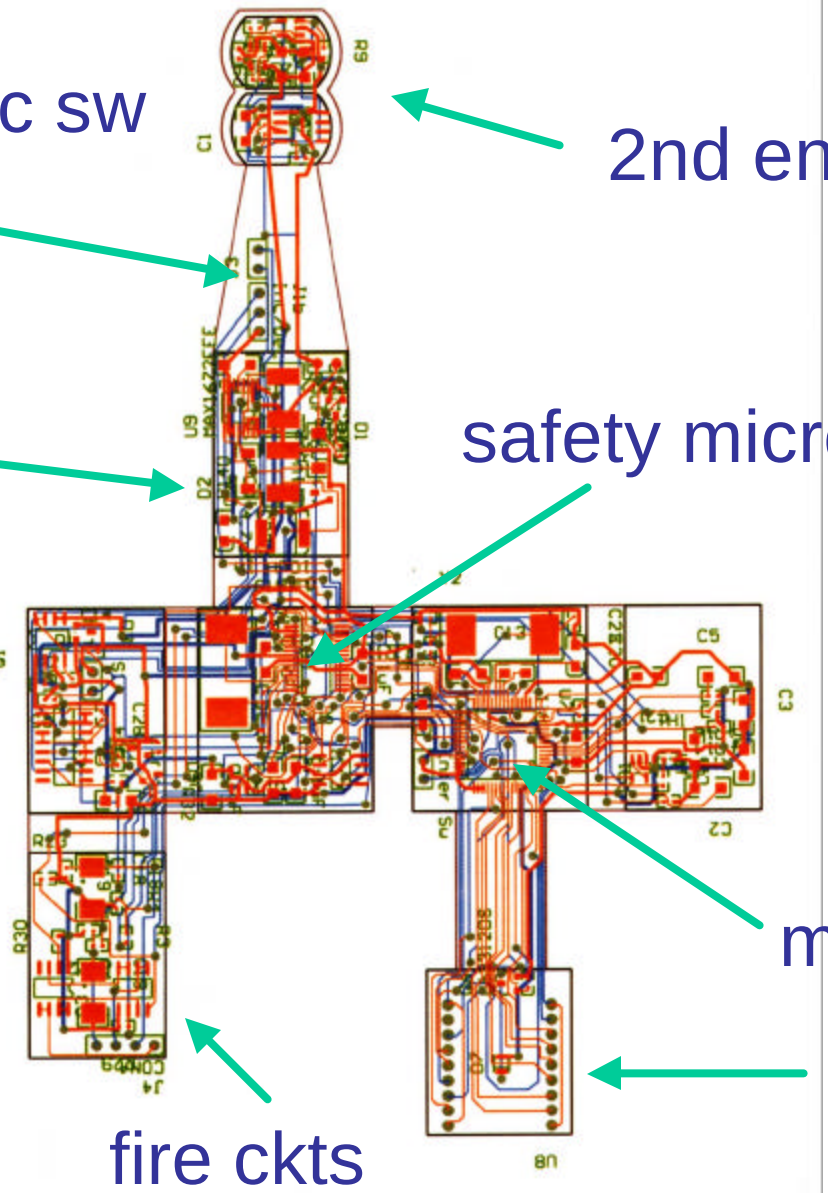


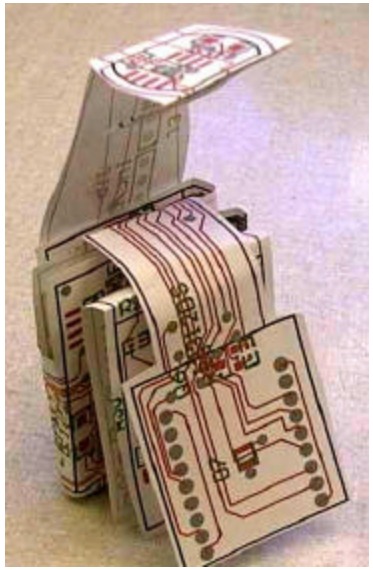
CUSTOM BREADBOARD

- PWR & GND plane
- Surface mount IC footprints
- Two PIC emulators

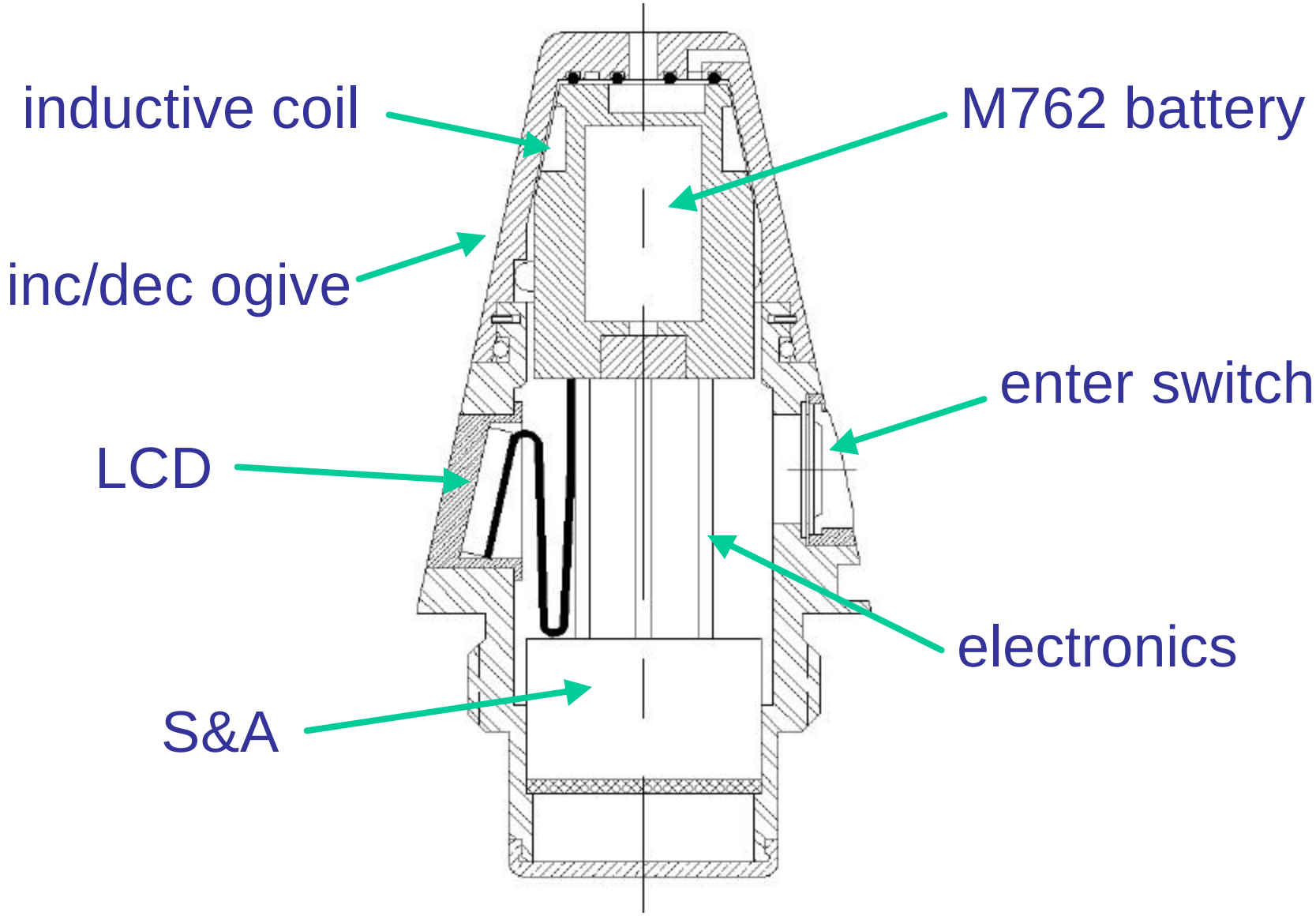


PROTOTYPE PWB

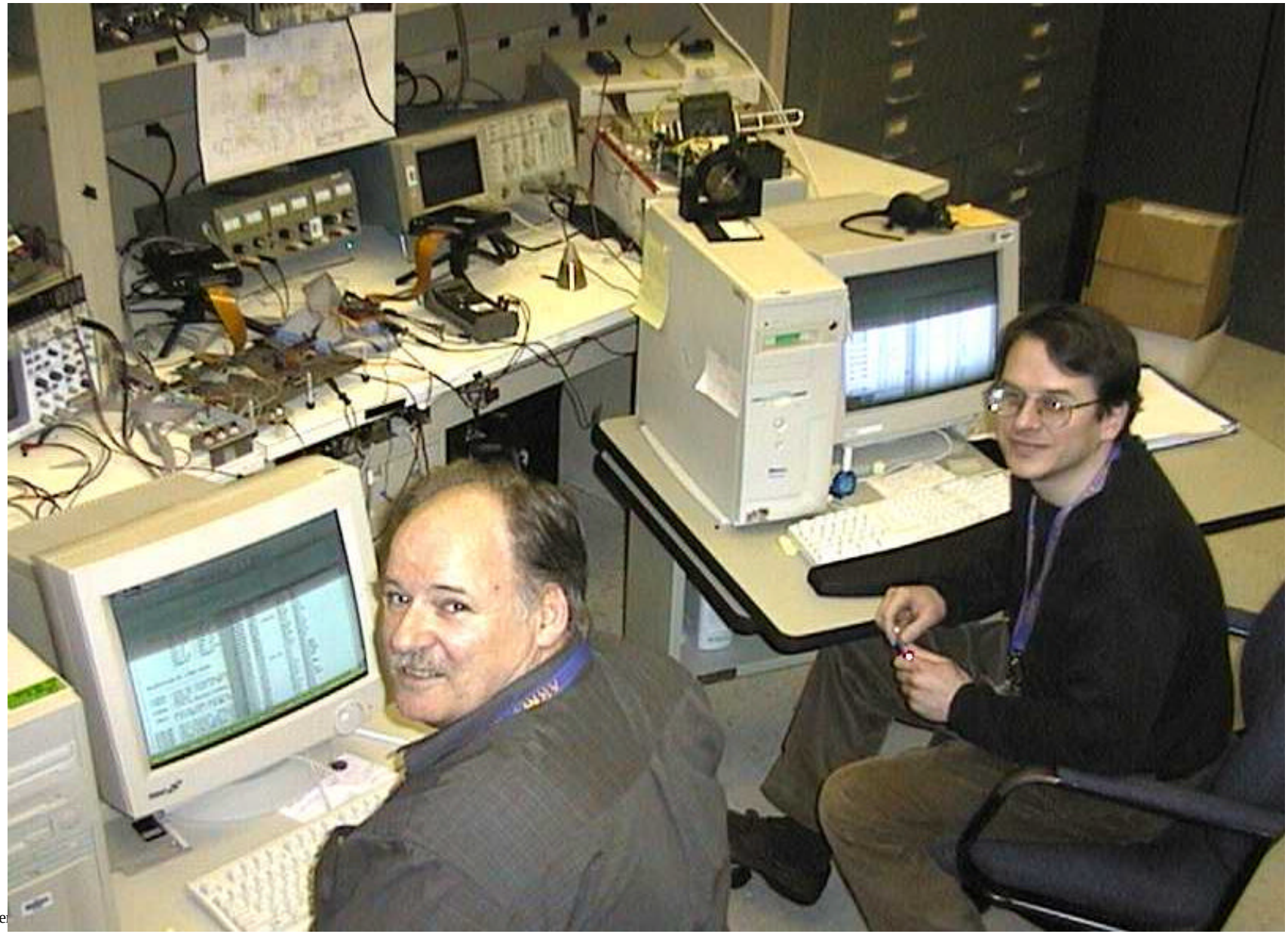




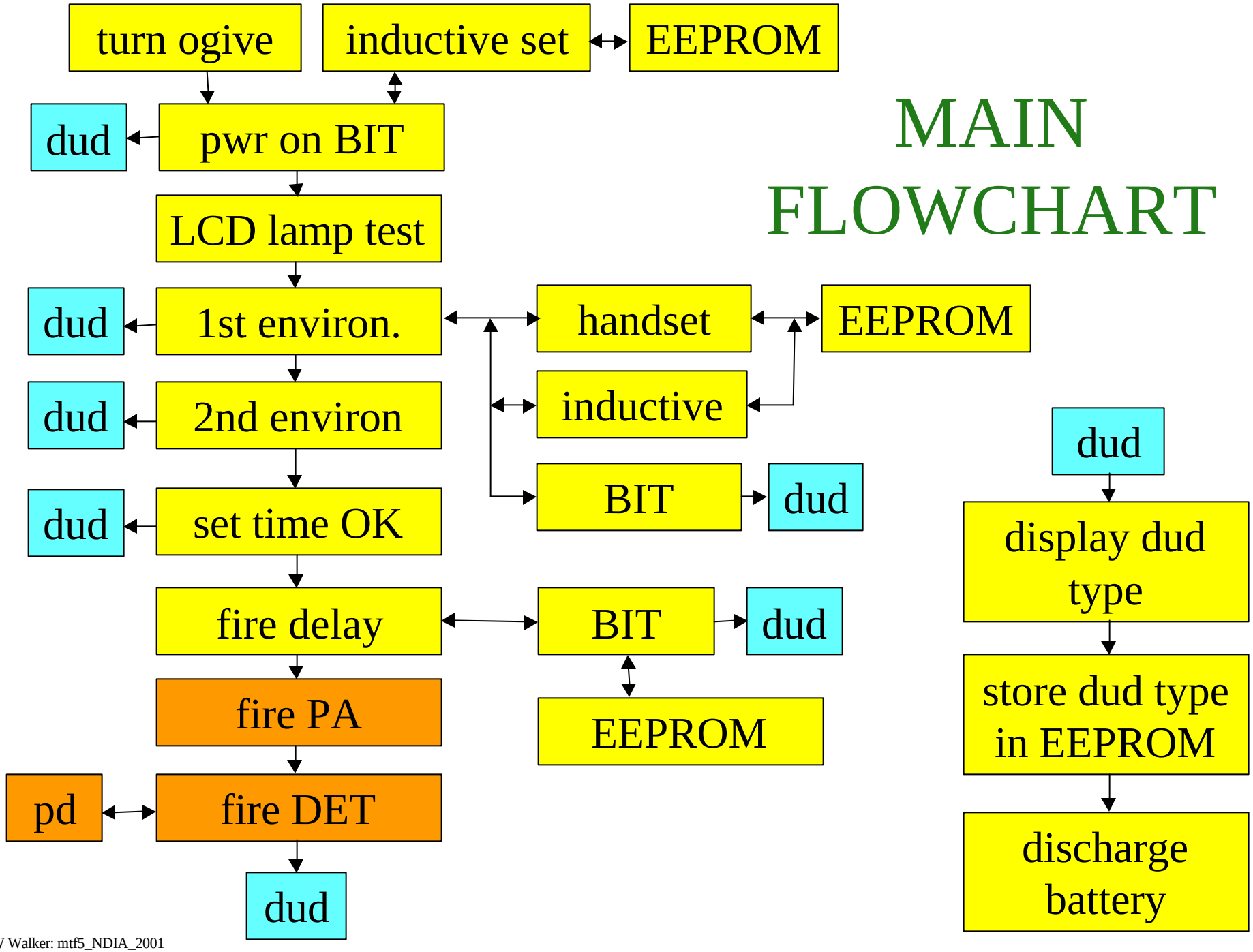
CROSS-SECTION VIEW



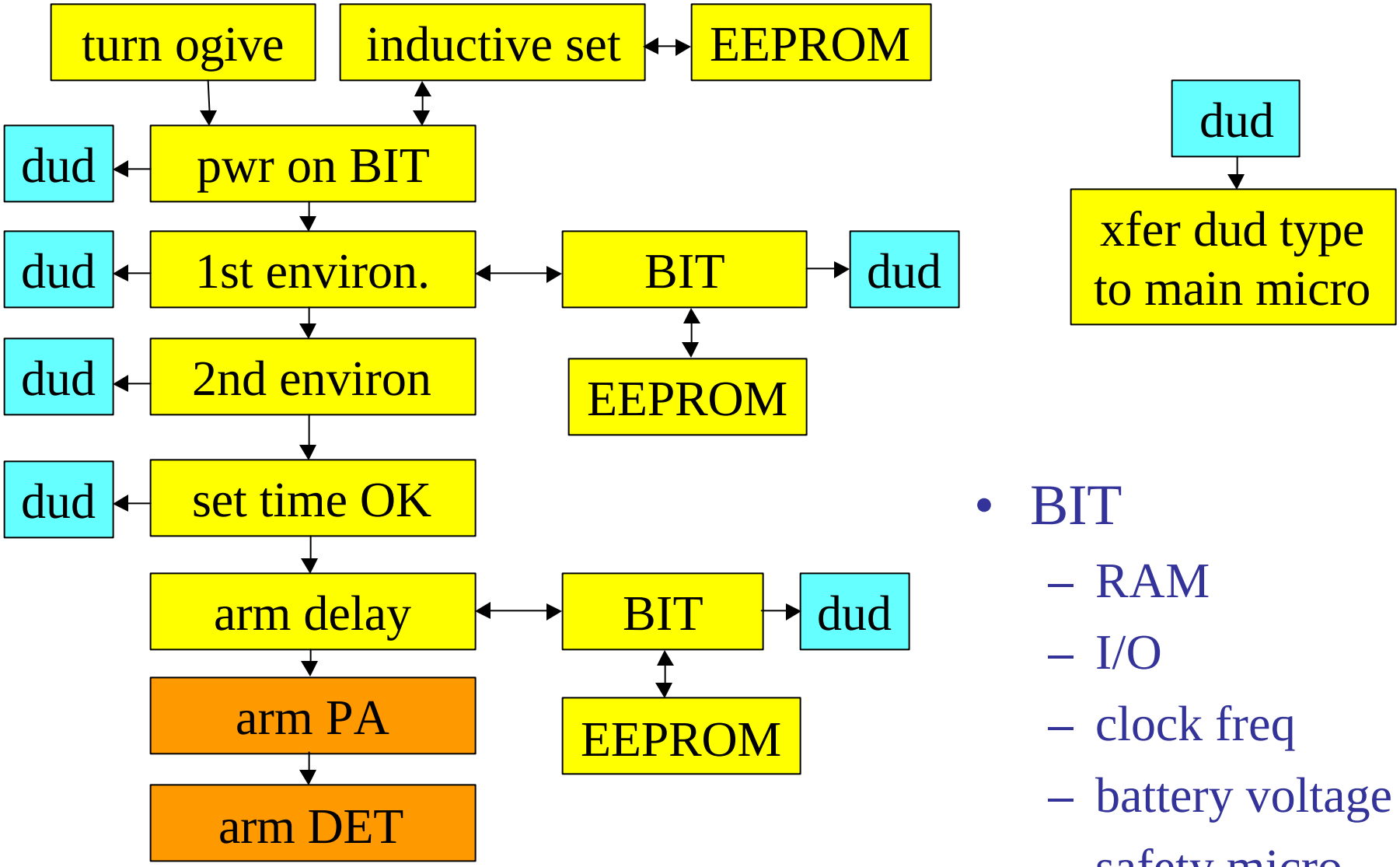
SOFTWARE DEVELOPMENT



MAIN FLOWCHART



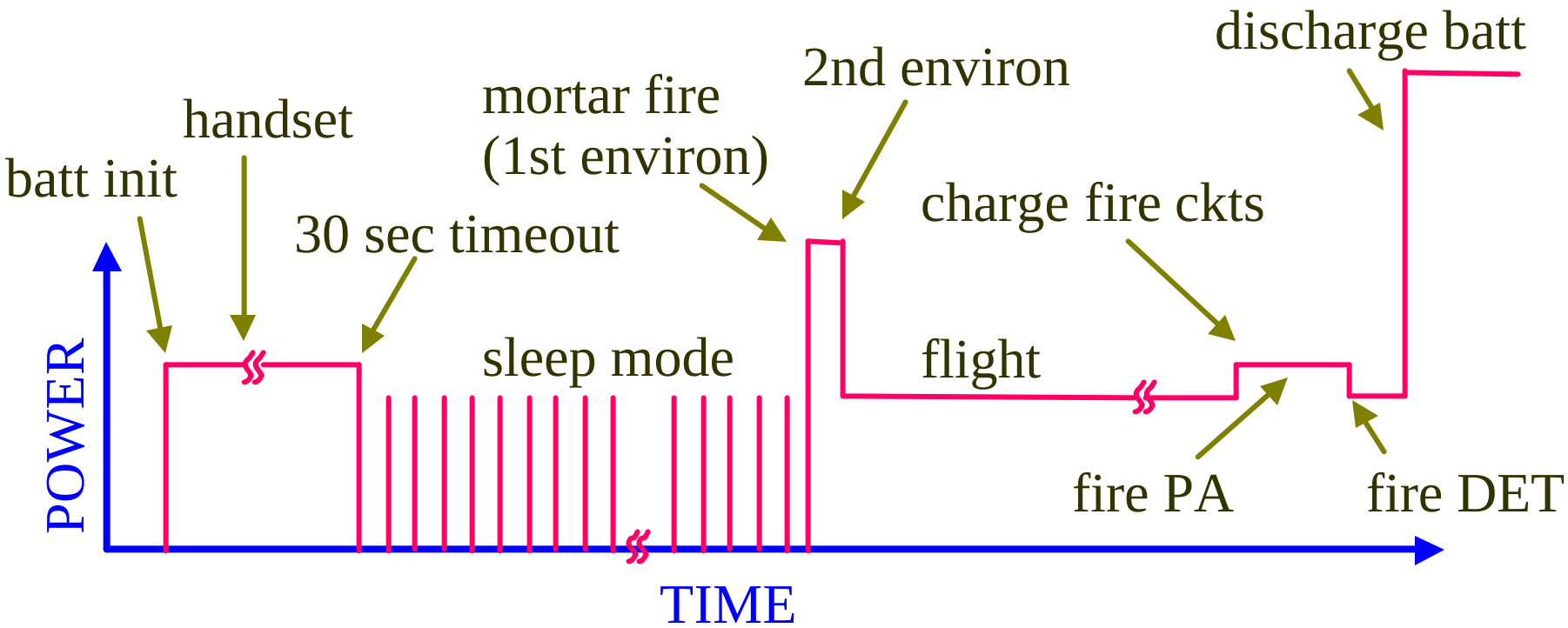
SAFETY FLOWCHART



- BIT
  - RAM
  - I/O
  - clock freq
  - battery voltage
  - safety micro

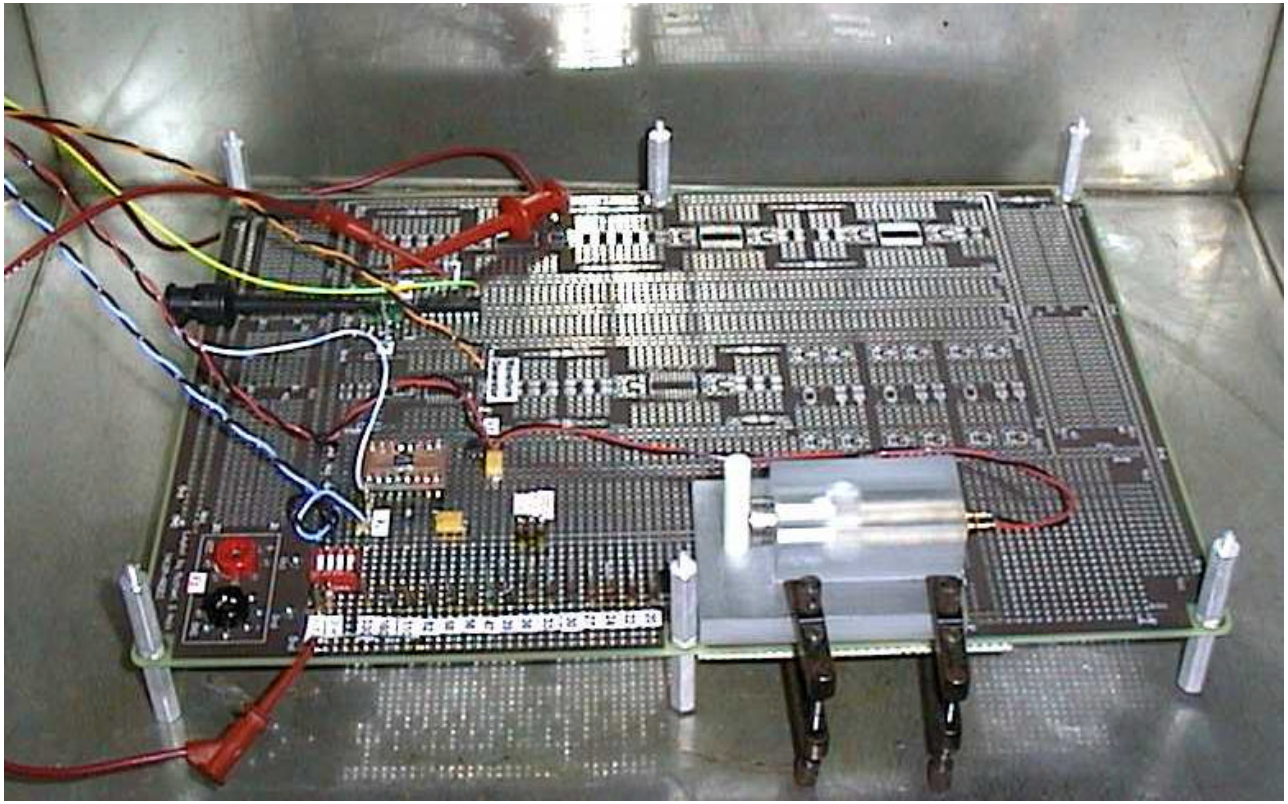
POWER CONSUMPTION

- Electronics
  - 33 mW active
  - 0.5 mW sleep
- Backlight = 7 mW
- 2nd environment
  - 45 mW gun muzzle
  - 5 mW pressure
- Fire ckts = 1 mW



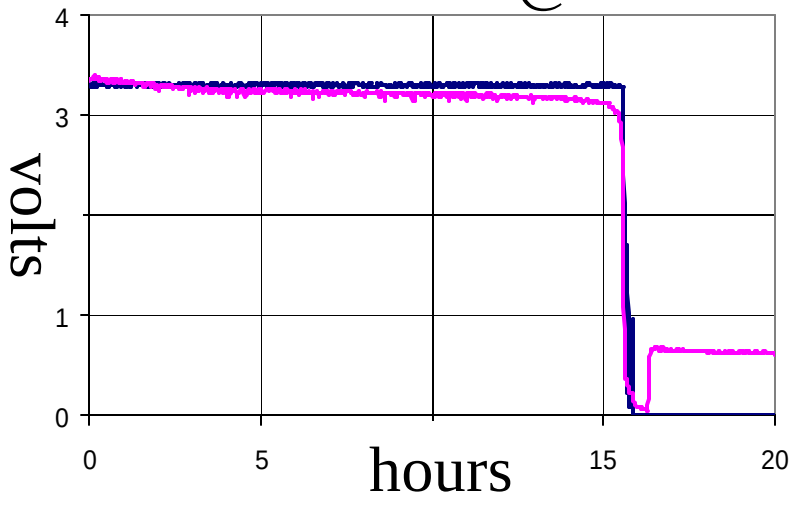
BATTERY

- 3 day requirement
- M762 battery
- 3.6 volt lithium thionyl chloride

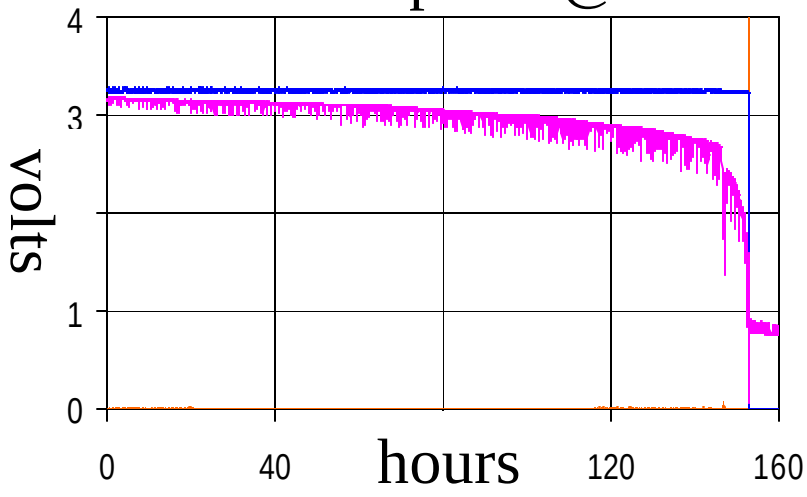


BATTERY TESTS

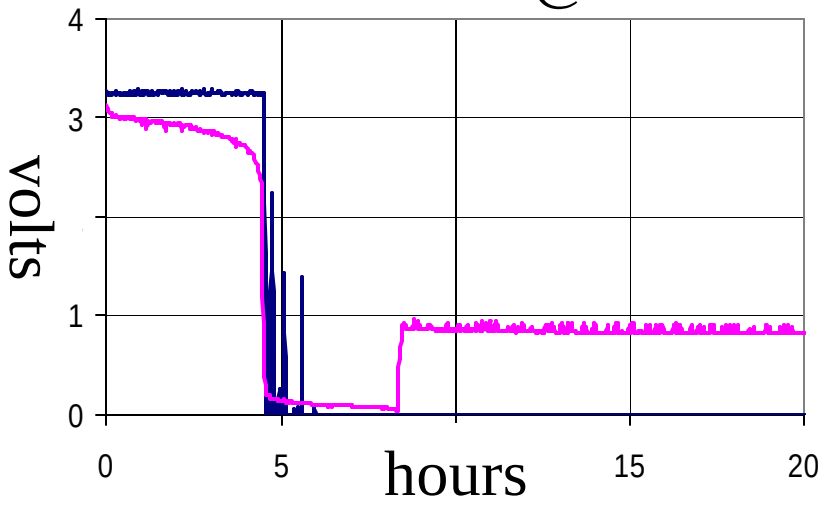
10 mA constant @ +23 °C



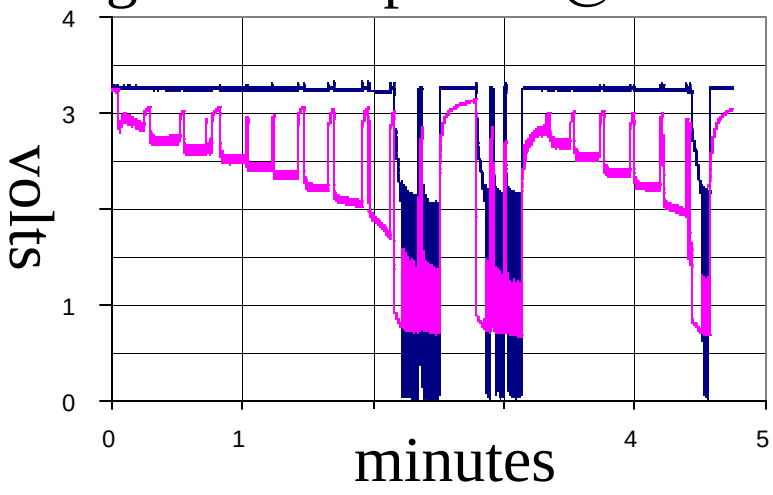
10 mA 1/20 pulse @ -43 °C



10 mA constant @ -43 °C



high current pulses @ -43 °C

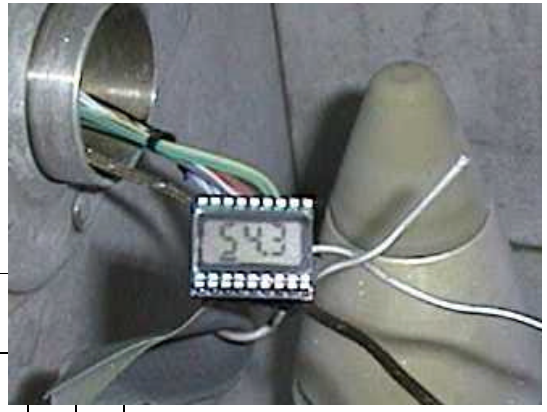


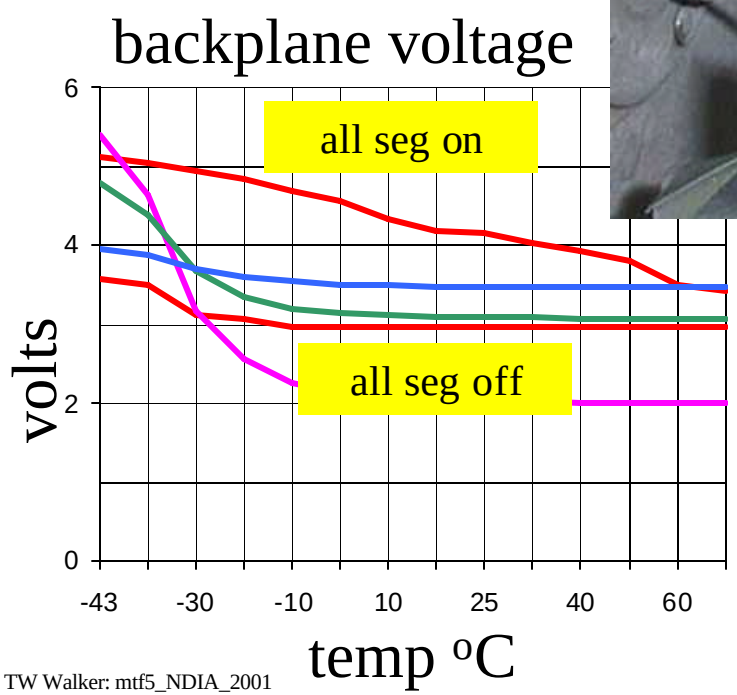
BATTERY TEST RESULTS

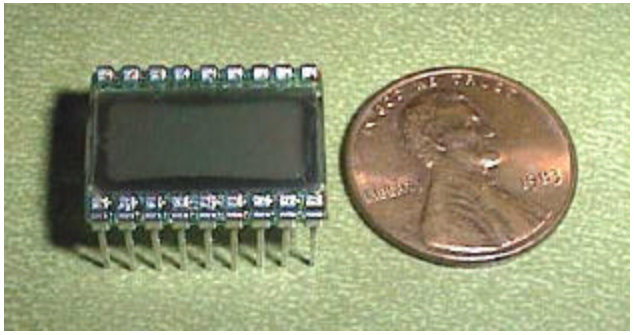
actual			
TEST	**TEMP (^{o}C)**	**TIME (hrs)**	**CAPACITY (mA hrs)**
10 mA constant	+63	17	170
10 mA constant	+23	15	150
10 mA constant	-43	5	50
10 mA @ 1/20 duty cycle	-43	150	75
10 mA @ 1/10,000 duty cycle	-43	3,125 days	75
extrapolated			

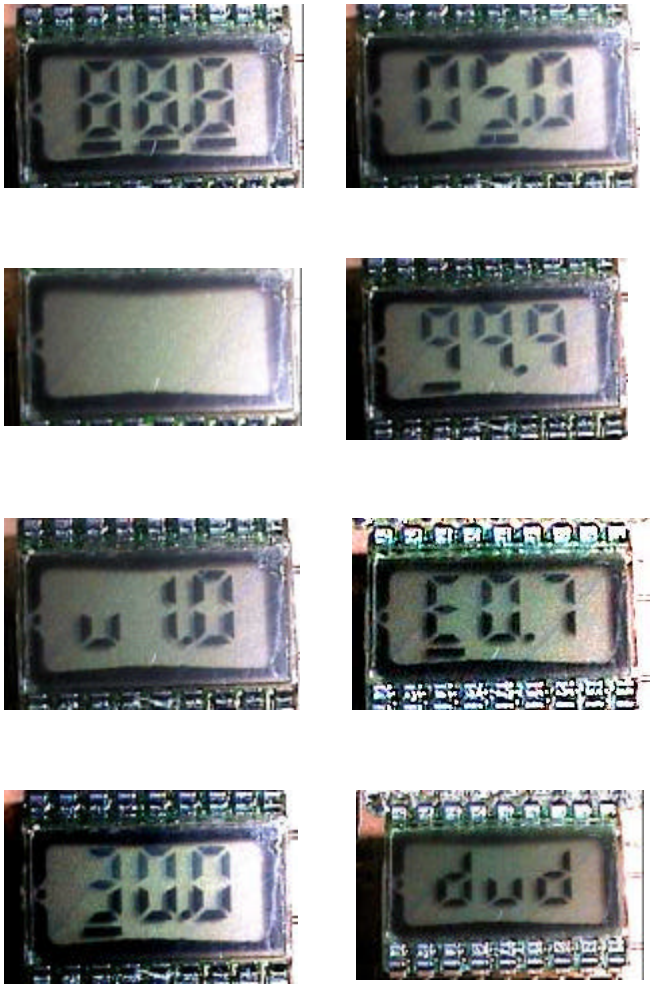
LCD

- 2:1 multiplex
- Adj backplane voltage over temp
- PWM backlight: 30 sec turnoff
- M762 derivative



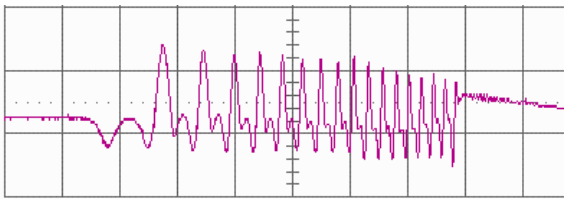




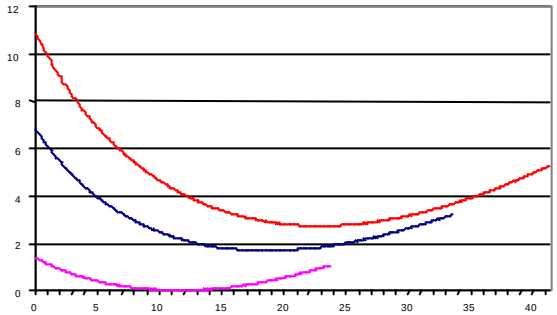


2nd ENVIRONMENT

- Gun muzzle exit sensor
  - 3 gun tubes

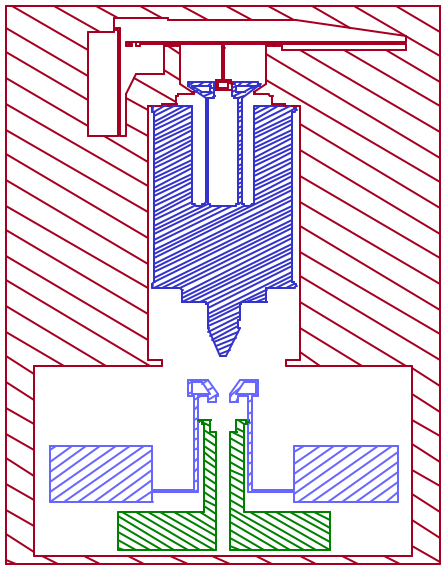


- Flight pressure sensor
  - low charge

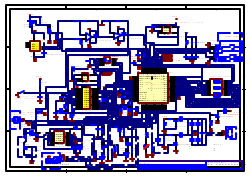
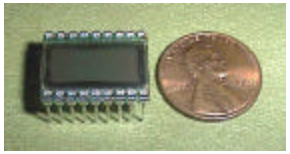
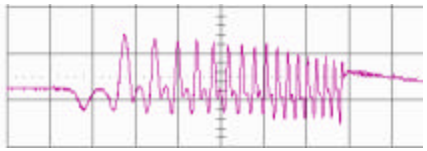
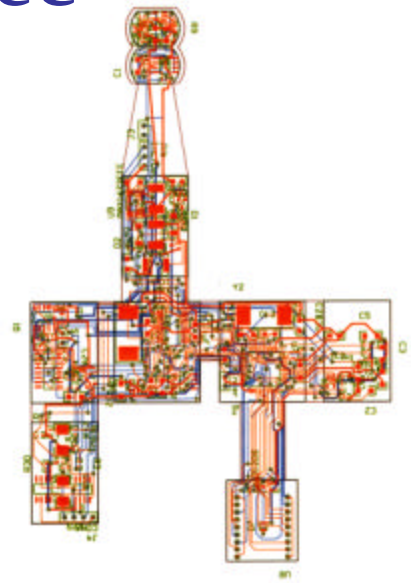


FUTURE WORK

- Conduct safety review of system electronics
- Continue evaluation of 2nd environ sensors
- Design MEMS inertial switch
- Fabricate handset models
- Obtain user feedback
- Award EMD contract



CONCLUSION

- In-house electrical design meets spec
- Fully functional breadboard
- Schematic 
- Prototype flex-circuit PWB
- Software program for both micros
- M762 battery
- LCD 
- 2nd environment prototypes