

## Improved surface fuzing concepts have been explored for every new reentry system

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- Faster-responding impact sensors
  - concepts include:
    - faster-sensing mechanisms
    - forward deployment of traditional sensors
  - little, if any, additional protection against impact irregularities
- Radar proximity fuzing
  - adequate survivability for all impact scenarios
  - little, if any, degradation in burst height effectiveness

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## Inertial Devices

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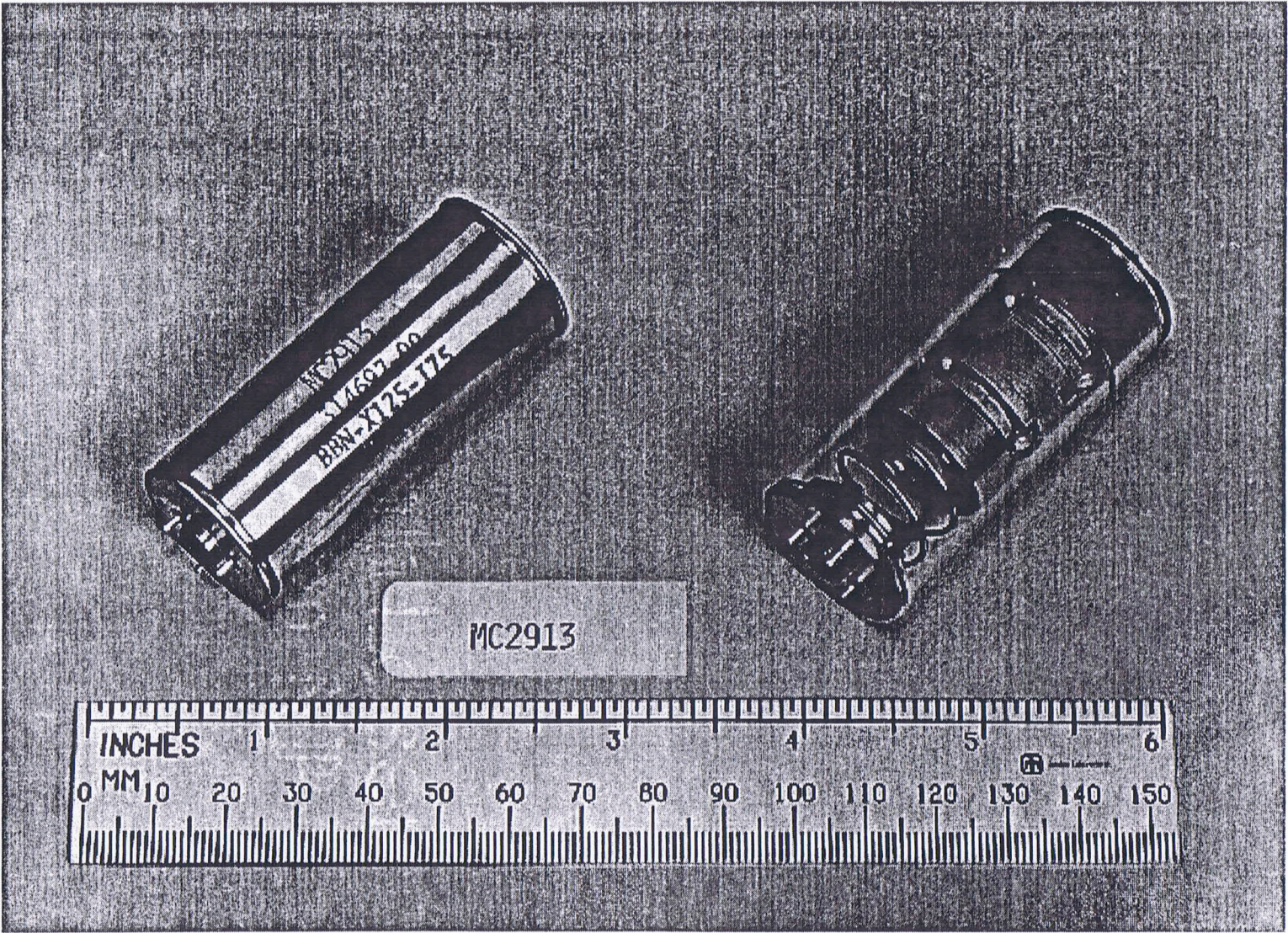
- **Mechanical** g-switches & integrating accelerometers
  - Stand-alone inertial fuze or initiation of reentry timer fuze
  - Closure of electrical contacts cause by completion of sensing mass travel
  - Features to attain minimum g's and g-seconds
    - Fluid-metering
    - Escapement mechanism
  - Mechanical feature variations limit accuracy to 1%
  - Extensive use as nuclear safety switches
- **Electronic** integrating accelerometers
  - Stand-alone inertial fuze or part of "path length" mechanization
  - Control circuitry generates "restoring current" proportional to acceleration
  - Provides continuous measurement of integrated deceleration
  - Electrical circuit tolerancing controls accuracy to 0.1%

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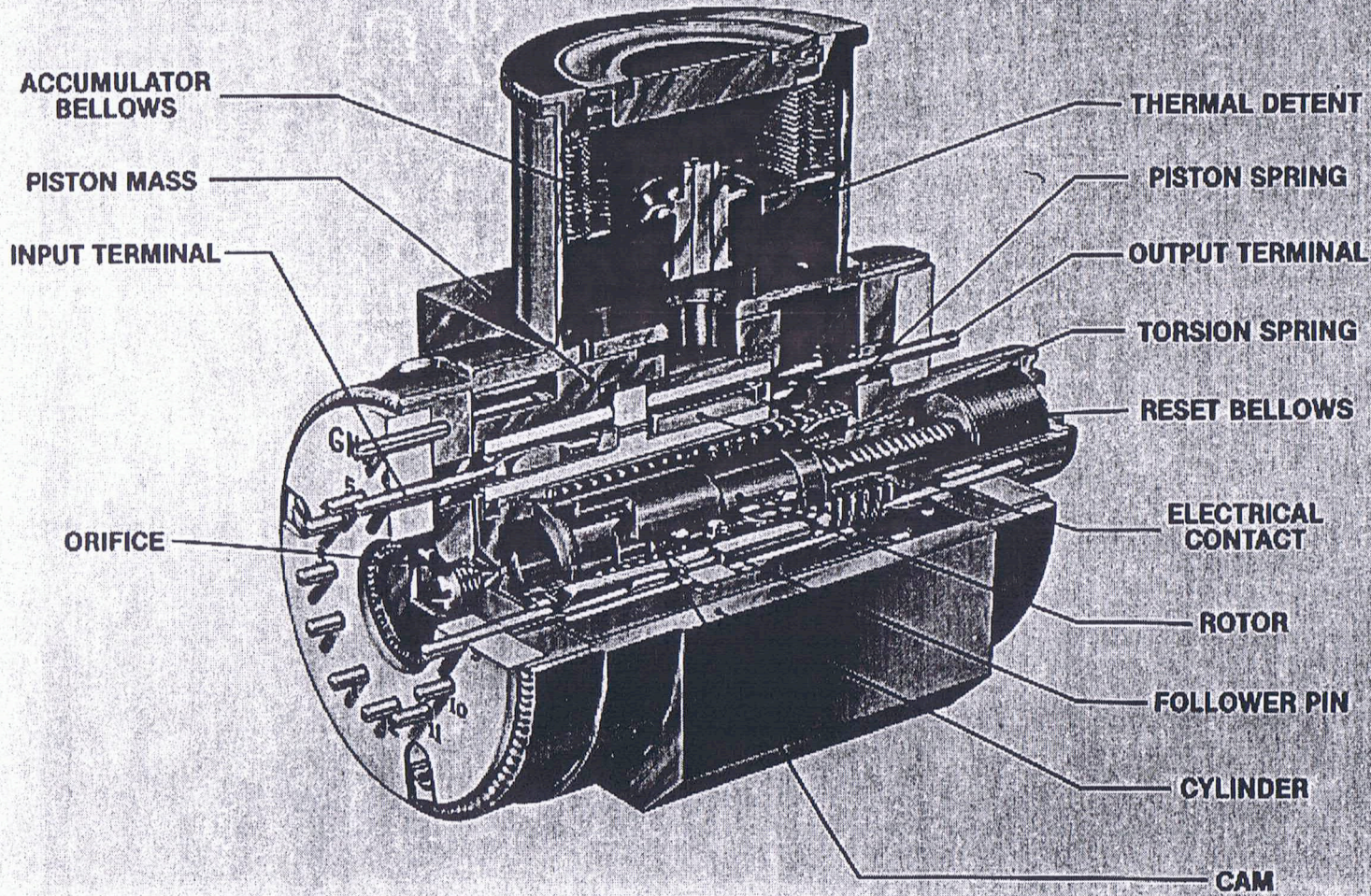
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# MC3600 INERTIAL SWITCH



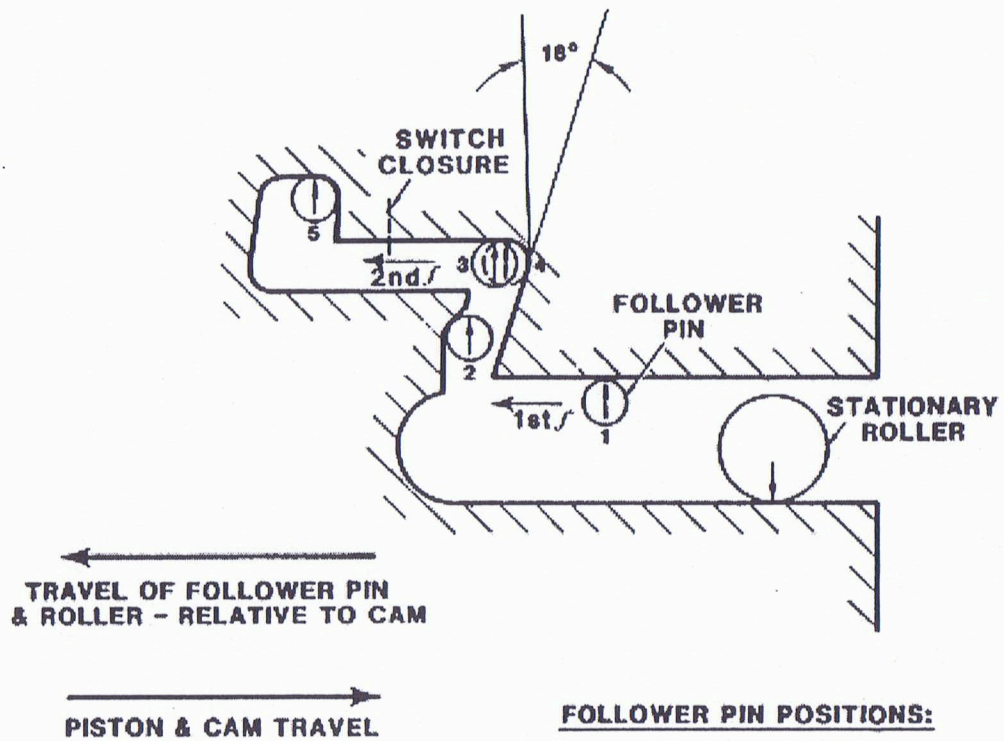
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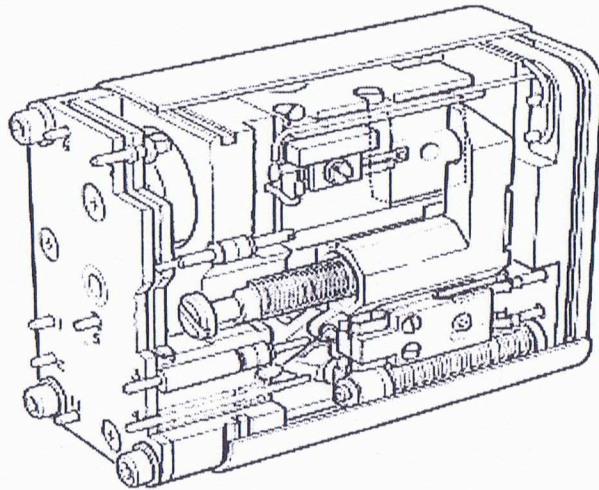


FOLLOWER PIN POSITIONS:

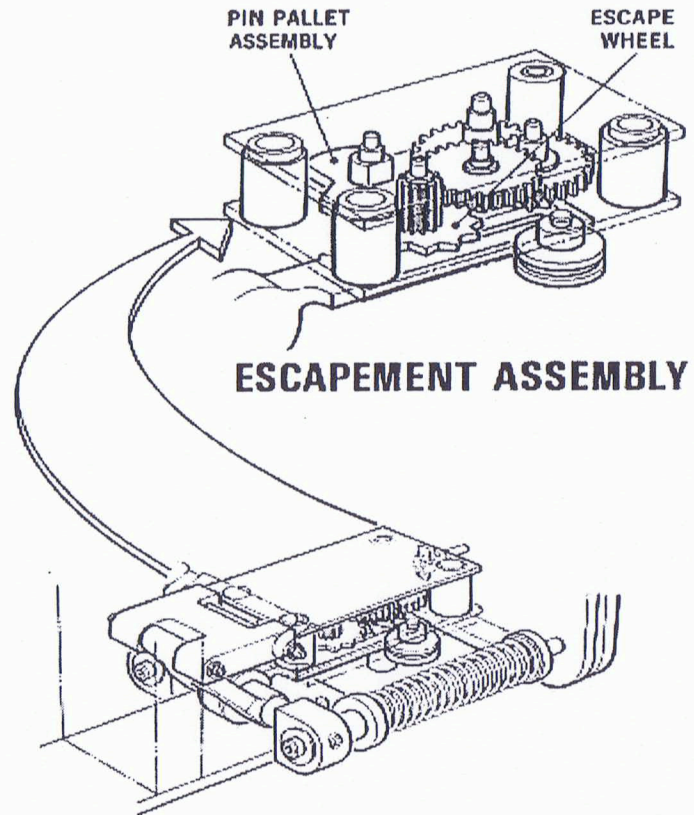
1. RESET
2. 1st STAGE INTEGRATION (PISTON STOP)
3. DROP-THROUGH (PISTON BACKUP)
4. MIDPOINT REST
5. 2nd STAGE INTEGRATION & LATCH

TWO-STAGE CAM SCHEMATIC

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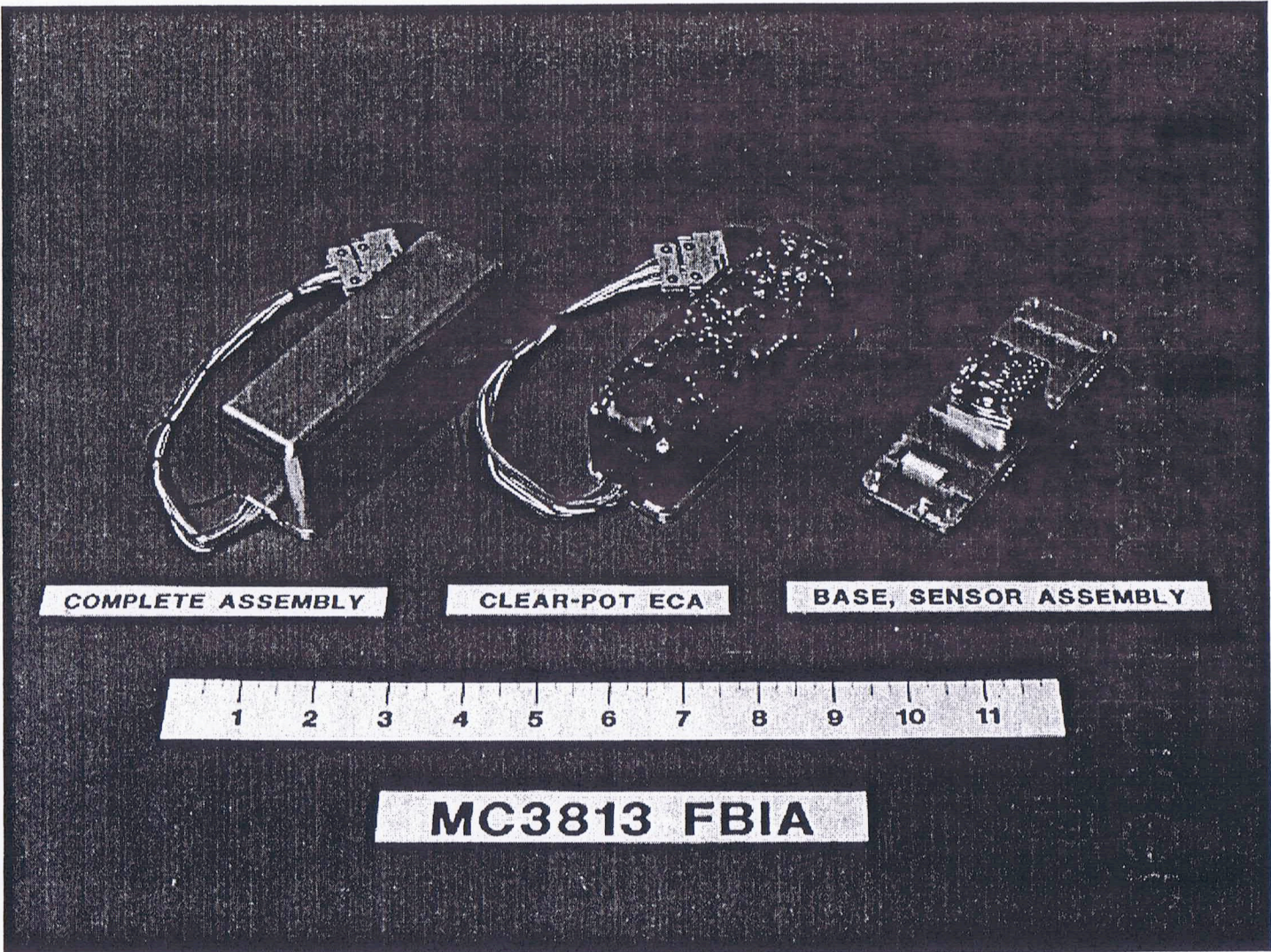
**MC 2897 INERTIAL SWITCH**



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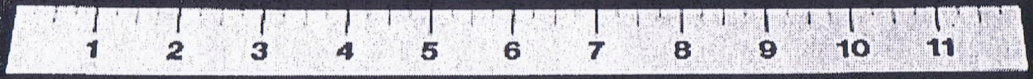




COMPLETE ASSEMBLY

CLEAR-POT ECA

BASE, SENSOR ASSEMBLY



MC3813 FBIA

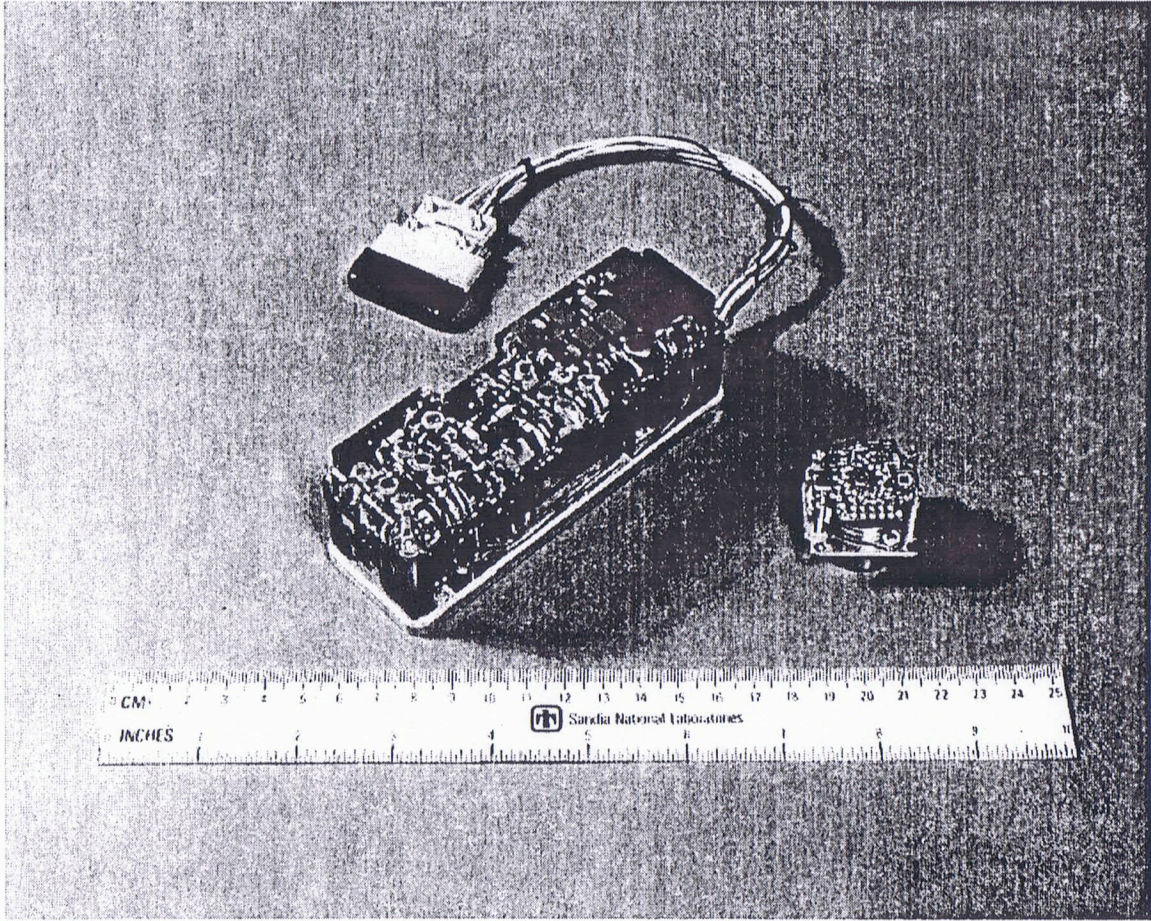
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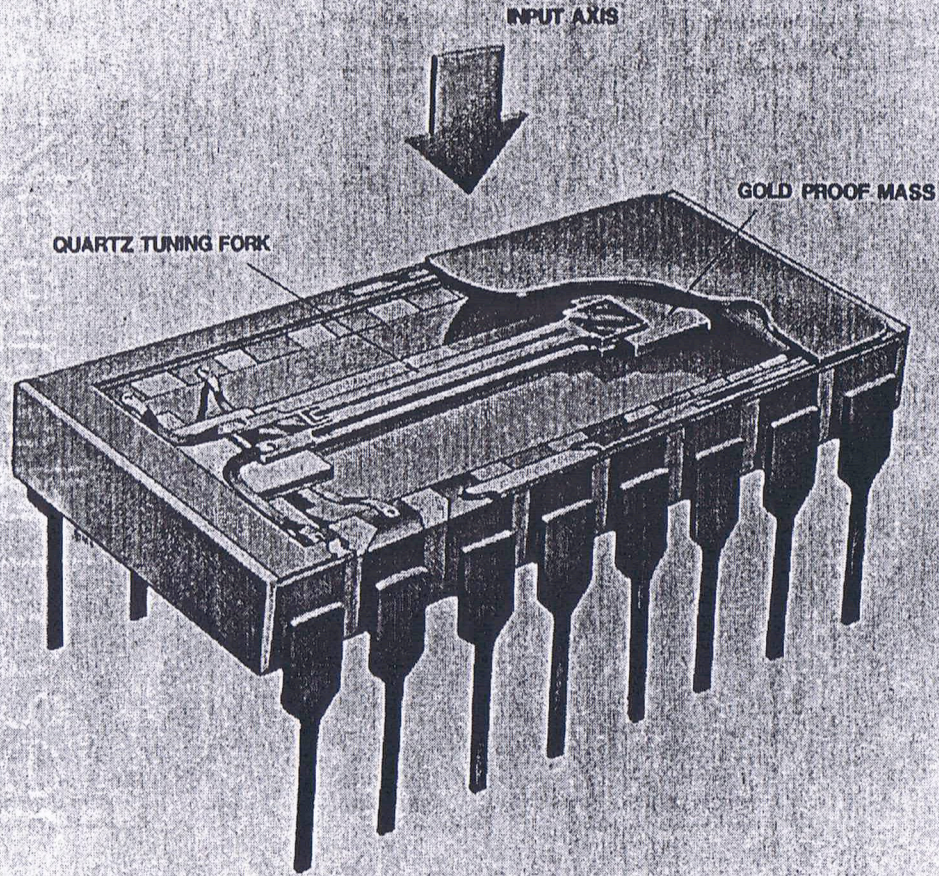
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QUARTZ CRYSTAL ACCELERATION SENSOR



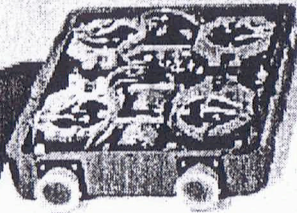
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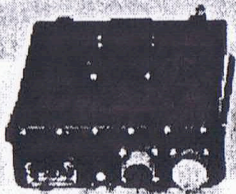


# Barometric Switches

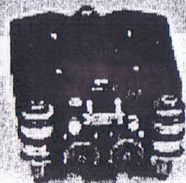
MC5 1951  
4 element-remote set  
Fuzing



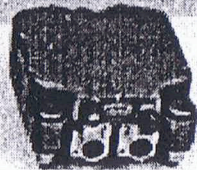
MC10 1952  
4 element-remote set  
Fuzing



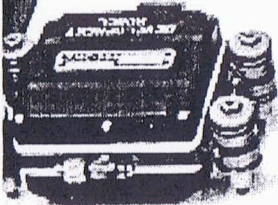
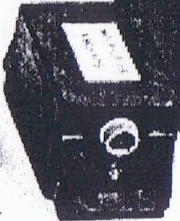
MC48 1952  
4 element-fixed  
Arming



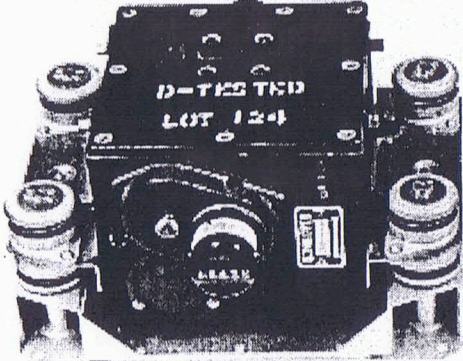
MC273 1954  
4 element-fixed  
Arming



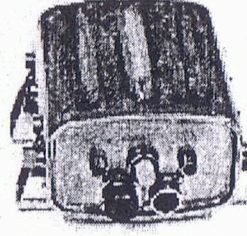
XMC157  
4 element-remote set  
1967 technology



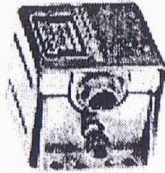
XMC586 1958  
4 element-remote set  
Fuzing



MC665 1957  
8 element-dial set  
Arming & Fuzing



MC1266 1962  
4 element-remote set  
Arming & Fuzing



MC1312 1962  
4 element-fixed  
Option select

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# Timers

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- Reentry body fuzing
  - Primary fuze on older systems
  - High altitude fuze and/or backup to radar on recent systems
  - Candidate fuze for earth penetrating weapons
- Bomb fuzing
  - Also uses timer for safe escape in laydown mode
- Artillery projectiles and special munitions
- Depth bombs
  - Timer initiated by water impact or hydrostatic pressure

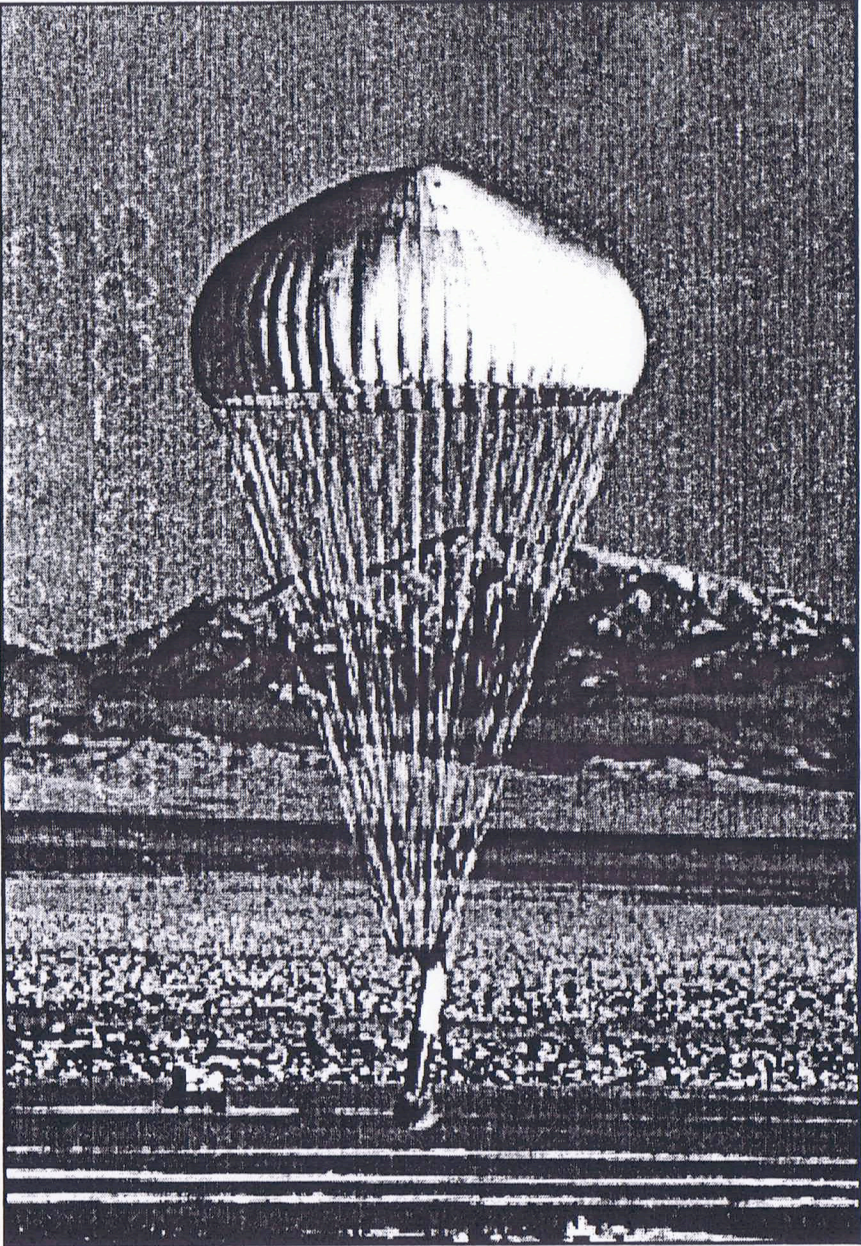
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## Timers (cont'd)

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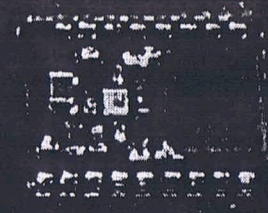
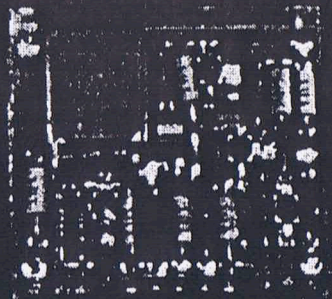
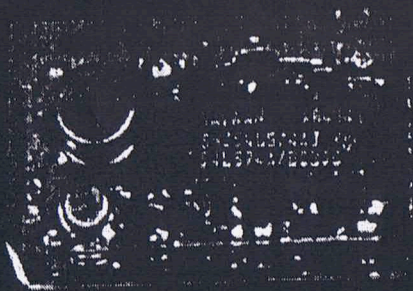
- Mechanism for initiating arming functions, I.e., batteries
- Critical element of any programmer and/or computer for warheads, bombs, guidance platforms, etc.
- Technology evolution
  - Mechanical      Approximately 5% accuracy
  - Electronic (LC)      Smaller with approximately 2% accuracy
  - Crystal      Smallest with accuracy measured in parts million

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# Some Clocks In Stockpile



MC3648  
B61-7

MC3827  
Trident II

MC4178  
B61JTA

MC4081  
B61-3,4,10

MC3852  
Code  
Activated  
Processor

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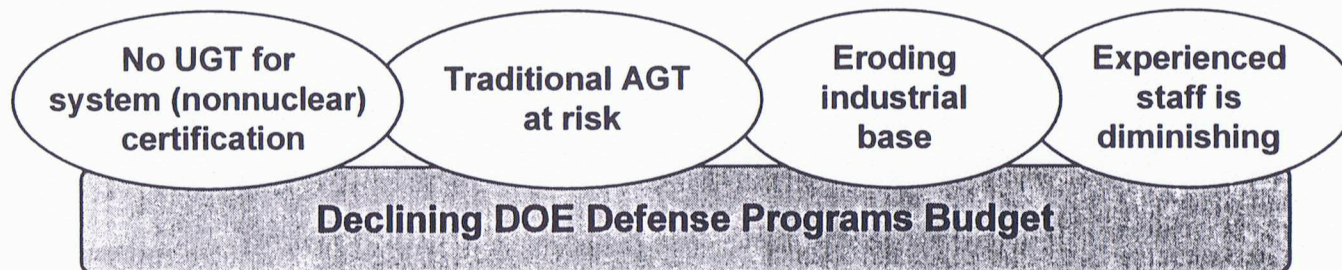


## Stockpile Stewardship will require Maintenance, Refurbishment & Repair

### Future:

- Performance certification (both current & new)
- Design & manufacturing (when required)

### Environment:



### Current need:

- Stockpile design options
- Capability sustainment

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# SWPP DoD/DOE MOU (draft)

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- Purpose for MOU

  - Program authorization

  - Roles & responsibilities

- Program Objectives

  - Exercise DOE capabilities relevant to SLBM

  - Demonstrate viability of system & component replacement options for W76 & W88

  - Emphasis on non-producible hardware and development of certification methods

  - Does not include fabrication of stockpile hardware

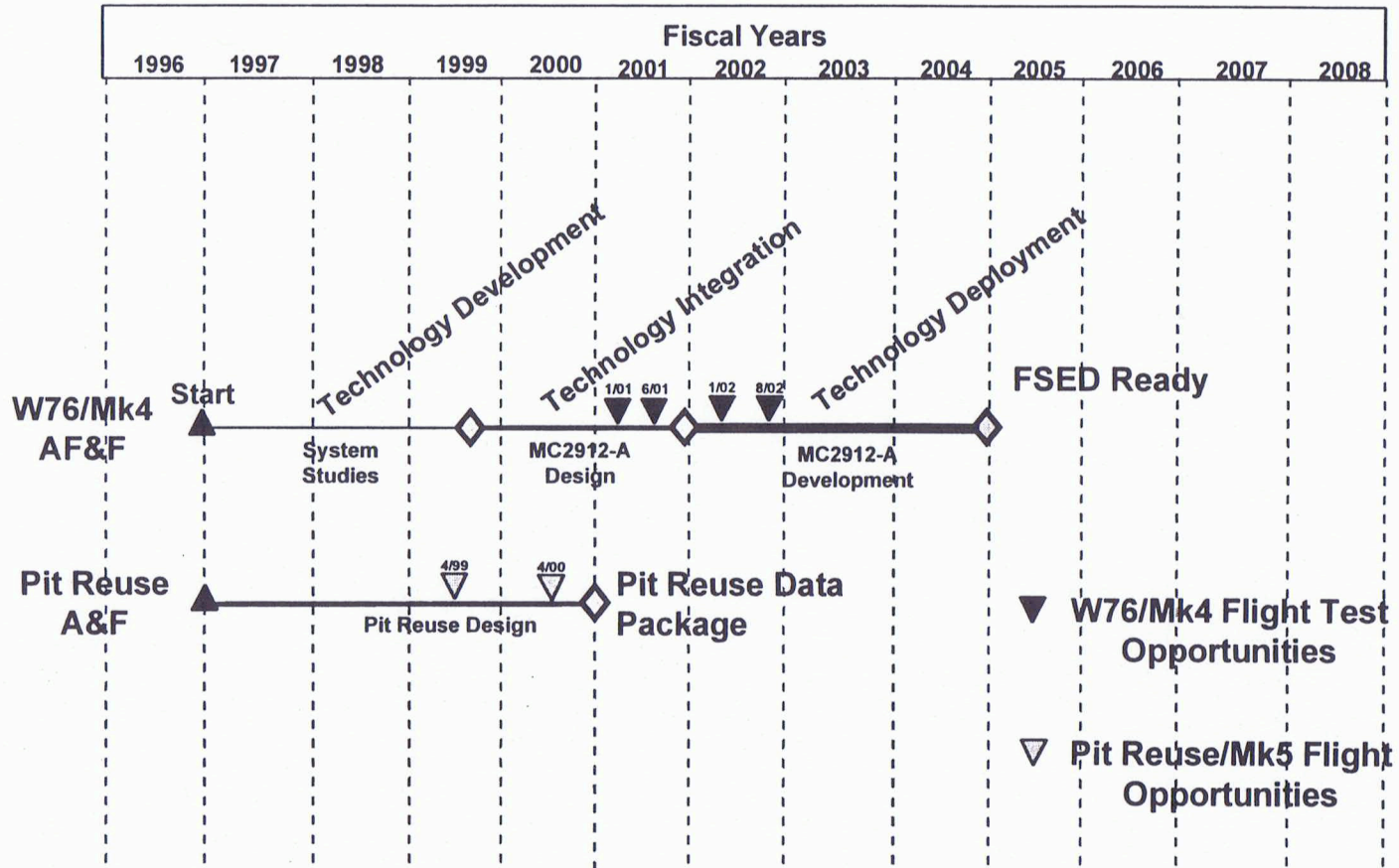
- Deliverable

  - Design Data Package for each option -- design definition, manufacturing & certification feasibility, identification of subsequent activities

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# Reentry systems advanced AF&F project



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# Fuzing options for replacement Mk4 AF&F

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## Mk4

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- airburst radar, 3 ranges
- inertial airburst, g-started timer
- contact backup

## Mk5

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- radar-update path length (RUPL)
- airburst radar, 5 ranges
- inertial airburst, path length
- high airburst, timer
- proximity radar
- contact backup

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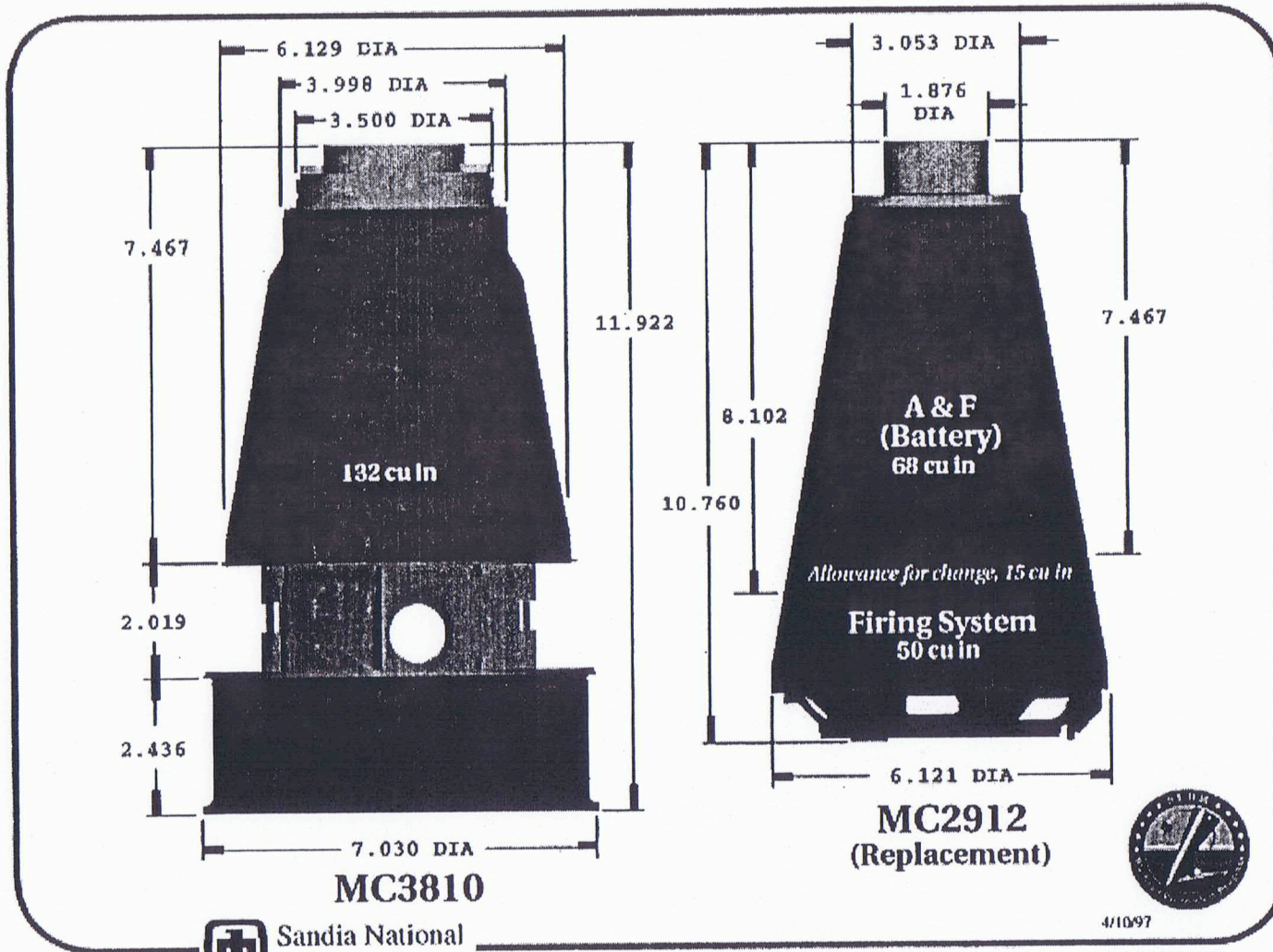
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# Fuzing options for replacement Mk4 AF&F

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← eliminate long-life thermal battery

← dormant electronics during coast

← minimum perturbation to existing antennas & RF system

← reduced clock accuracy requirements

← reduced inertial sensor accuracy requirements

Mk4

← simplified processing

Mk5

← reduced non-volatile memory requirements

← nuclear safety upgrades enabled →

← improved instrumentation →

dependable surface fuzing →

new fuzing option for Mk4 →

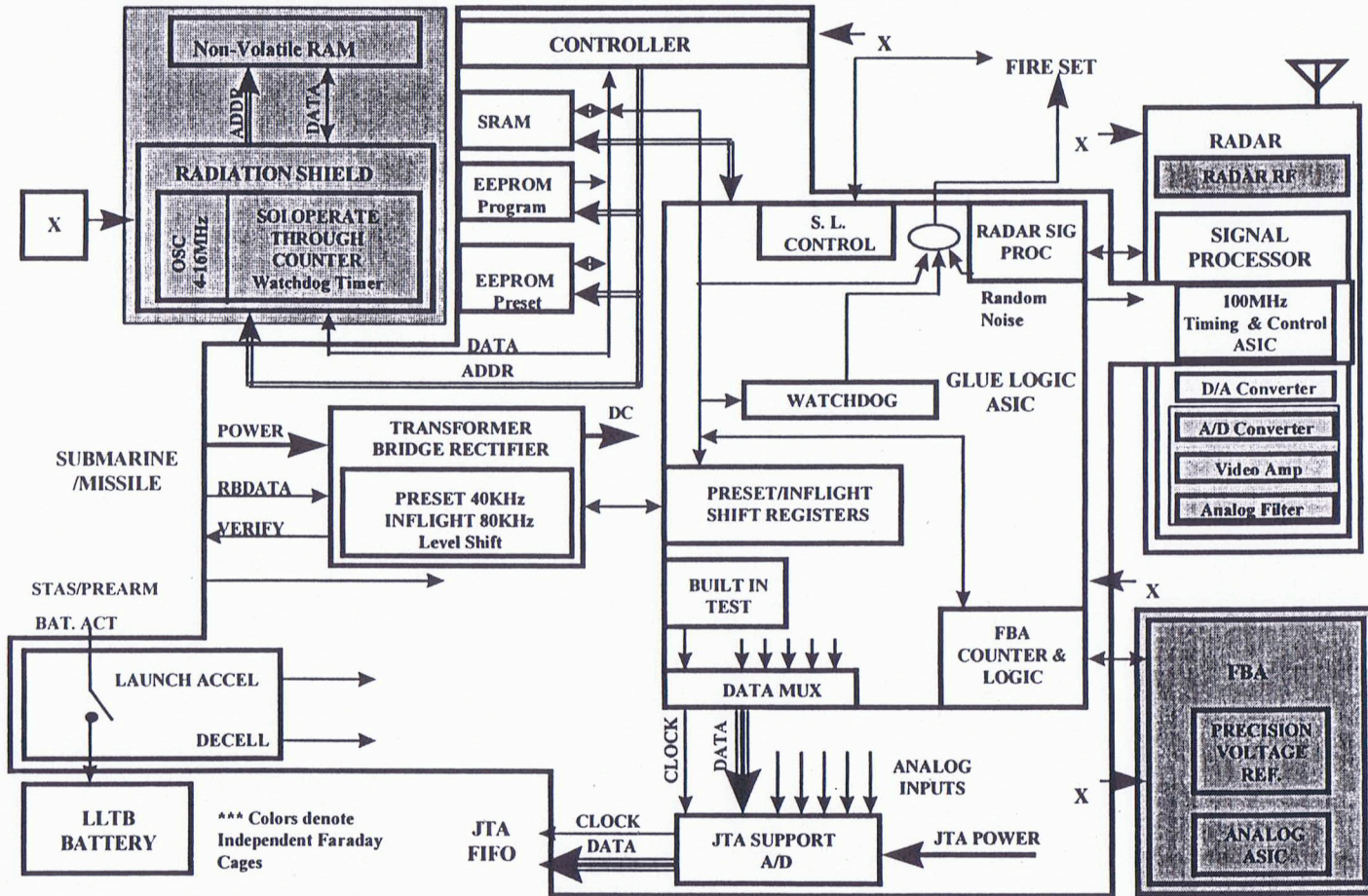
← *reduced development & production costs*

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# A&F architecture to support W76/Mk4 and Pit Reuse



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