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Challenges of Evaluating the Compliance of New Technology to Fuze Standards

The Right Tool for the Right Job

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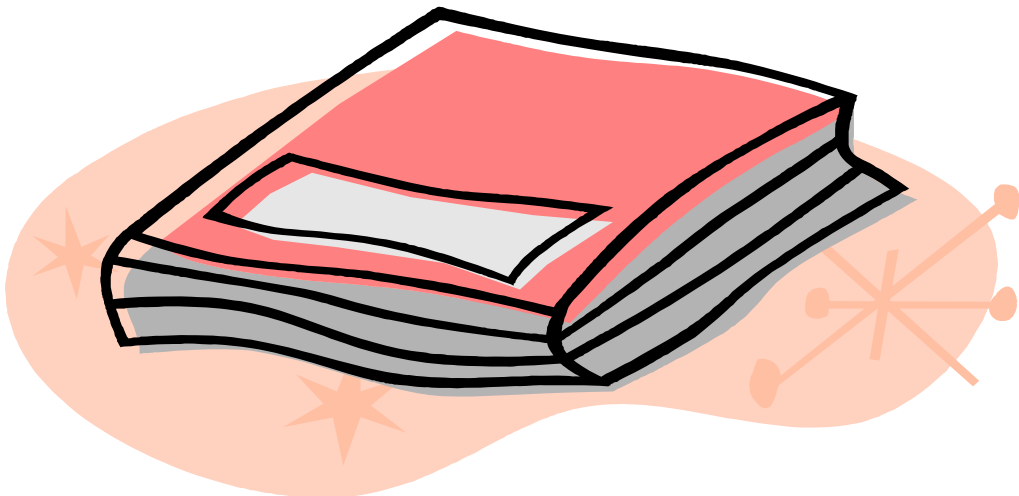
Abstract

This paper explores the challenges associated with designing and qualifying fuzes with new technology when using the existing fuze standards. Challenges occur when new technologies are incompatible with existing standard expectations, tests, and guidelines.



The Right Tool for the Right Job

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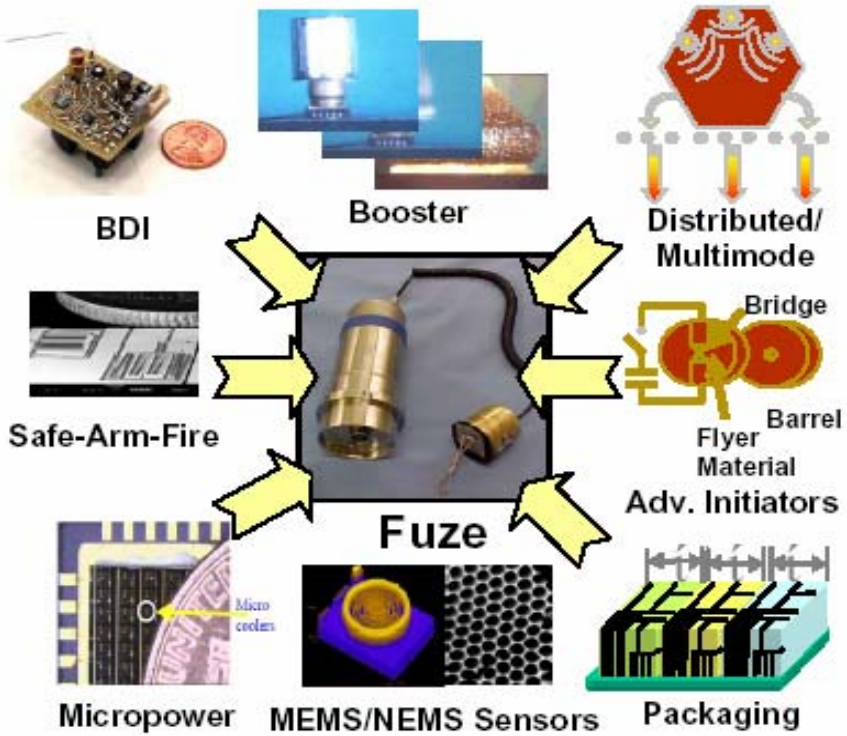
- Qualification test requirements should be evaluated to determine if they are obsolete. Some tests created to verify physical environmental qualification may no longer be valid.



Purpose of Paper

- To stimulate discussion of qualification requirements that should be examined
- Examine cost of over tests or non applicable tests
- Propose a Gov't/Industry working group to periodically review qualification requirements

Tests Examined in Paper

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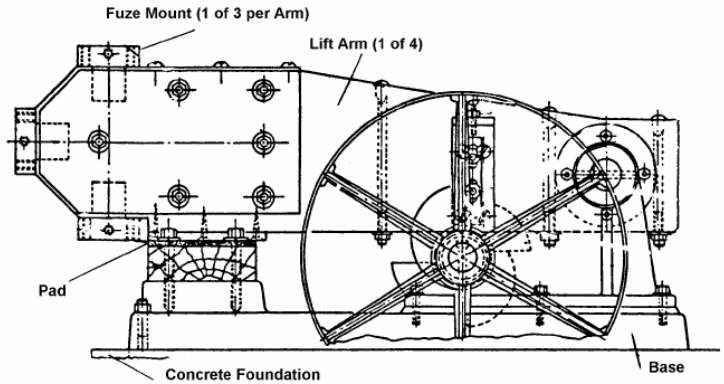
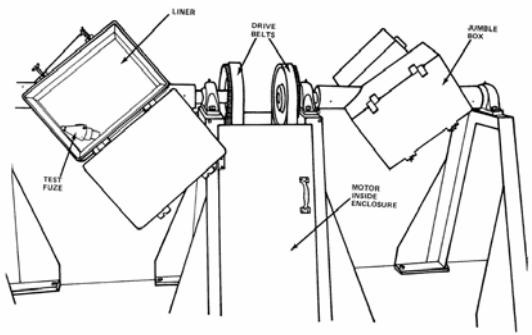
- Not an inclusive list, just examples of things that have been seen recently
- Jolt/Jumble
- Salt-Fog/28 Day T&H
- 40 ft drop
- Electrical Cook-Off
- Slapper Test

Tests to Examine

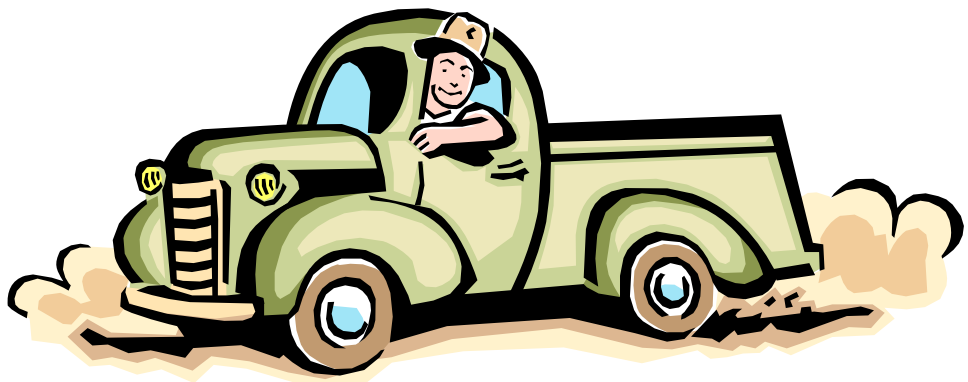
- Jolt/Jumble
  - Original Intent
    - Originally used to verify shock arming did not occur on mechanical safe and arm devices
  - Current Intent
    - Same intent for mechanical devices
    - Verify electronics do not become dislodged from circuit cards
    - Verify the electronics do not “reconfigure” into a hazard



Jolt

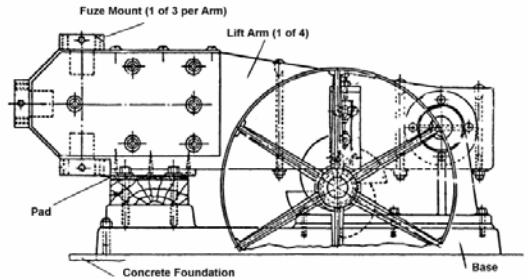


Jumble

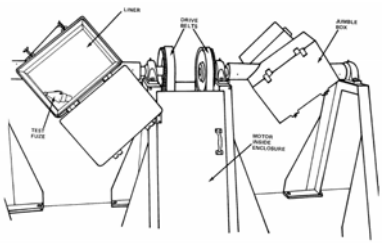


Tests to Examine (cont.)

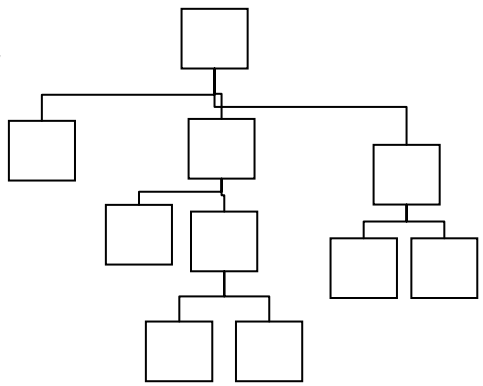
- Jolt/Jumble (cont.)
  - Examination required because:
    - Specification specifically states no energetic output, testing used to verify electronics survivability
    - Transportation vibration, operational vibration and appropriate shocks are used to verify mechanical attachments
    - Electronics “reconfigure” is more easily shown in a fault tree, there are so many possibilities that a 1 or 2 unit jolt/jumble test sequence that there is a low probability of finding a failure.



Jolt



Jumble



Fault Tree

Tests to Examine (cont.)

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- Salt-Fog/28 Day T&H on Hermetically Sealed Devices
  - Original Intent
    - Originally used to verify wet environmental conditions cause no degradation of the performance or safety of a fuze
  - Current Intent
    - Non Hermetic and Hermetically sealed devices are tested with the same test, verify that wet environmental conditions do not degrade the performance or safety of a fuze

Tests to Examine (cont.)

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- Salt-Fog/28 Day T&H on Hermetically sealed devices (cont.)
  - Examination required because:
    - Testing the “seal” and testing the “guts” is different
    - Hermetic seal is verified during fine/gross leak tests after shock and vibration, not “wet environment tests”
    - If seal is intact, tests will not verify that the “electronics” or “guts” have a sensitivity to “wet environments”, that verification should be tested with a unit that is not hermetic (non-production representative unit)

Tests to Examine (cont.)

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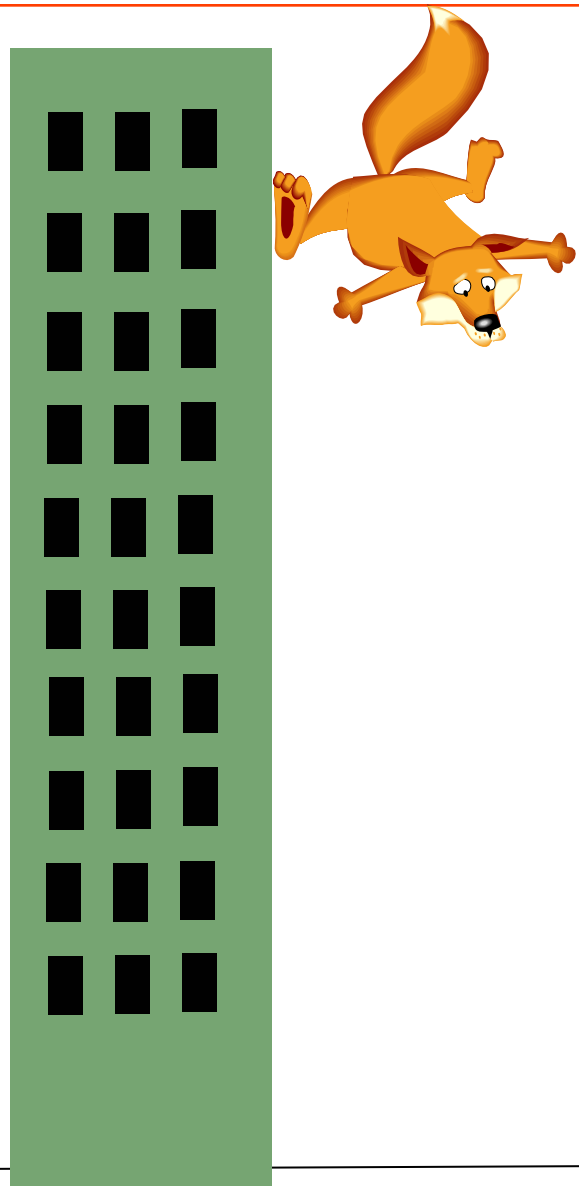
- 40 Foot Drop
  - Original Intent
    - Originally used because Fuzes and Missiles were shipped separately, verify fuzes would not cause catastrophic damage and be safe for disposal if it is dropped from 40-ft (loading onto a ship environment)
  - Current Intent
    - Verify fuze (in a weapon) would not cause catastrophic damage and will be safe to dispose of if weapon and shipping container is dropped while loaded onto a ship



Tests to Examine (cont.)

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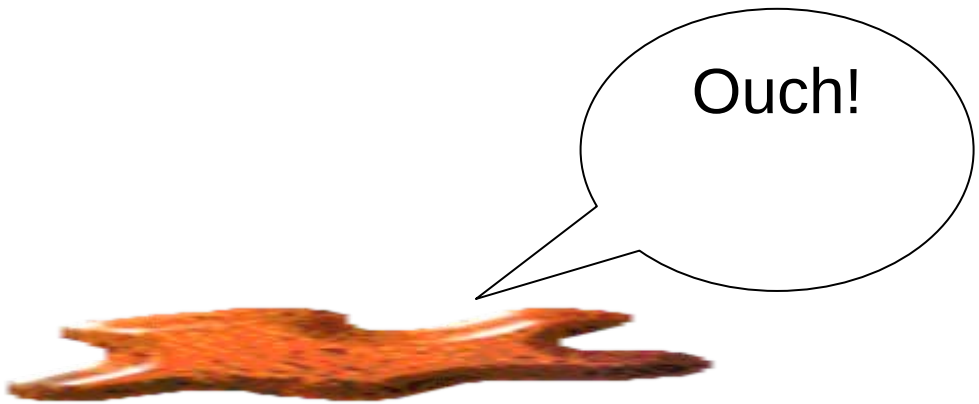
- 40 Foot Drop (cont.)
  - Examination required because:
    - Weapons are shipped with fuzes installed, bare fuzes are rarely shipped
    - Dropping a bare fuze from 40 ft does not represent the mechanical shocks and interaction that will be associated with dropping an All Up Round in a shipping container
    - Represents a possible over-test or non-representative test environment



Tests to Examine (cont.)

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- Electrical Cook-Off
  - Original Intent
    - Test the reaction of the bare EFI to exposure to common AC and DC voltage sources up to 500 volts.
  - Current Intent
    - Same as original intent

Tests to Examine (cont.)

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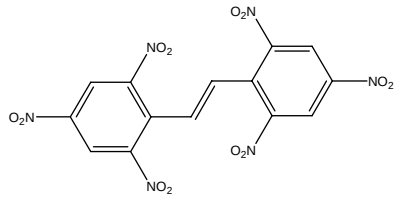
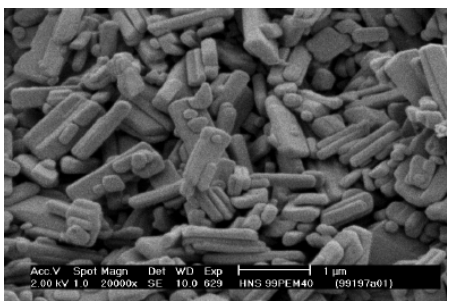
- Electrical Cook-Off (cont.)
  - Examination required because:
    - Missiles are shipped with fuzes installed, bare fuzes or just EFI's are rarely shipped to field
    - AC test requirement of 1 micro-second maximum rise time to full voltage into a 2.5 amp resistive load is difficult to achieve
    - Exposing the bare fuze or EFI to a high voltage source does not represent the interaction that will be associated with exposing the all-up round to a high voltage source

Tests to Examine (cont.)

- SLAPPER test (certify HNS-IV and HNS V to MIL-E-82903)



  - Original Intent
    - Provide a standard performance test for all HNS IV/V acceptance across manufacturing sources
  - Current Intent
    - Test HNS IV/V for performance in designed configuration
  - Examination required because:
    - No suppler of HNS will certify to MIL-E-82903 due to this slapper test



Cost of Compliance

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- Compliance drives Industry to perform testing regardless of value or program cost
  - Less risk to test than to explain/debate
  - Less ultimate cost to test than to explain/debate
- Not changing out-dated requirements forces fuze designs to survive tests and environments that are not realistic

Cost of Compliance (cont.)

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- Test results lack crisp correlation with safety or performance success
  - What is passing?
  - What requires re-test?
  - Can be subjective

Recommendation

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- Expand the FESWG to include industry
  - Add prime and supplier representatives
  - Hold working group meetings to discuss potential obsolete tests and to discuss/add new tests that have industry input.

Questions?

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