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TAKE THE FUZE SAFETY DESIGN QUIZ, PART I

61st NDIA Fuze Conference, May 2018

Presented by: Homesh Lalbahadur
Army Fuze Management Office
ENTERPRISE AND SYSTEMS INTEGRATION CENTER (ESIC) / ARDEC

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FUZE SAFETY DESIGN QUIZ

1. Out-of-Line and In-Line are two possible Safe & Arm architectures. Which of the following is the most important factor in determining which architecture is appropriate?

A. Selection of explosive materials
B. Selection of electrical power source
C. Available operational environments

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2. Explosive materials are designed to detonate and are characterized via three sensitivity levels: Primary Explosive; Secondary Explosive; and Tertiary Explosive. Only Primary Explosives are permitted to be used in an In-Line S&A architecture. True or False?

A. True

B. False

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3. The distance at which the fuze becomes armed is called:

A. Safe Separation Distance
B. Arming Delay Distance
C. Safe Escape Distance
D. A & B

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4. Safe separation distance is the minimum distance at which the hazards posed by the functioning munition are acceptable. True or False?

A. True

B. False

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5. US fuze safety authorities recognize the safe separation distance as the shortest distance at which the probability of hit by a hazardous fragment from the functioning of a munition is:

A. 10^{-6}

B. 10^{-4}

C. 10^{-2}

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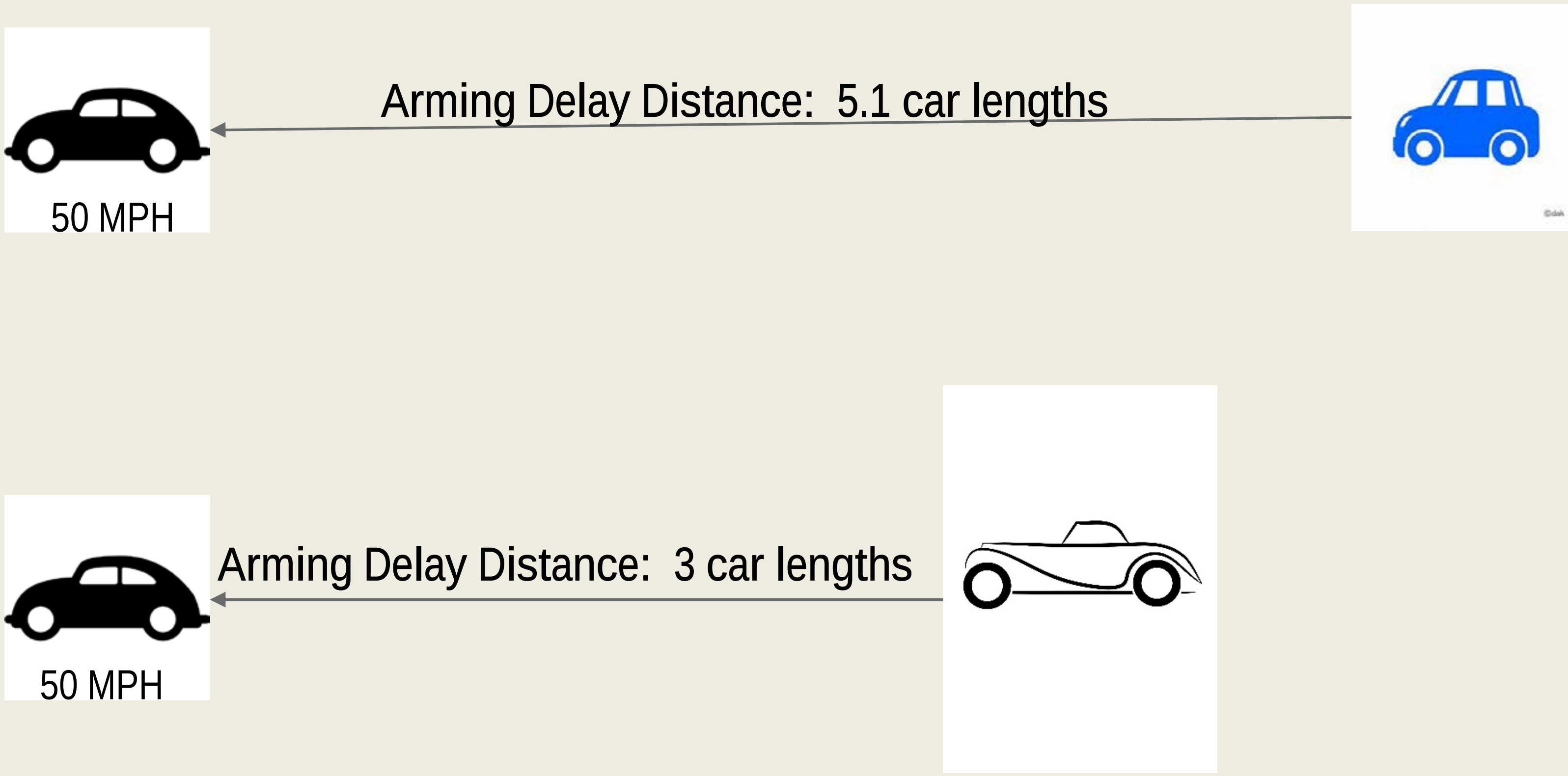
6. Fuze safety design standards require the fuze minimum arming delay distance be equal to or greater than the safe separation distance posed by the munition. True or False?

A. True

B. False

Safe Separation Distance: 5 car lengths (Determined by vehicle safety authorities)



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7. When evaluating an out-of-line or in-line design, the definition of "armed" is not defined the same as when evaluating performance reliability. True or False?

A. True

B. False

DEFINITION OF "ARMED" in MIL-STD-1316F

a. A fuze employing explosive train interruption (see 5.3.3) is considered armed when the interrupter(s) position is ineffective in preventing propagation of the explosive train at a rate equal to or exceeding 0.5 percent at a confidence level of 95 percent.

b. A fuze employing a non-interrupted explosive train (see 5.3.4) is considered armed when the stimulus available for delivery to the initiator equals or exceeds the initiator's maximum no-fire stimulus (MNFS).

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8. From the *fuze safety design perspective*, a main thrust of a fault tree analysis (FTA) is to examine the design to ensure single point safety failure modes do not exist. True or False?

A. True

B. False

9. In the *fuze safety design world*, the probability numbers employed in a fault tree analysis (FTA) should be obtained from:

A. Conservative engineering judgement
B. Quality Assurance and Inspection data
C. Past performance/historical data
D. MIL-HDBK-217F (Military Handbook: Reliability Prediction Of Electronic Equipment)
E. B & D

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10. Electronic power should be applied to the fuze safety system as late as possible in the employment cycle (e.g., upon irrevocable intent-to-launch command, etc.). True, False, or Maybe?

A. True
B. False
C. Maybe

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11. For an in-line system architecture (i.e., ESAD), a dedicated independent arming environment should be utilized to enable a dedicated static switch. True or False?

A. True

B. False

FUZE SAFETY DESIGN QUIZ

12. For an in-line system architecture (i.e., ESAD), what is the preferred method to activate the dynamic arm switch?

A. The dedicated independent arm environment inputs to both static switches should be combined and used towards controlling activation of the dynamic arm switch.

B. Use only the most robust of the two arming environments to control activation of the dynamic arm switch.

C. There is no preference since enabling the dynamic arming switch is a reliability concern. the S&A control logic is already partitioned into two independent static switch drive elements which is comparable to requiring dual safety for a mechanical S&A device.

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13. It is acceptable to use a microcontroller by itself to execute safety logic functions if once programmed, the microcontroller is disabled from being reprogrammed. True or False?

A. True

B. False

FUZE SAFETY DESIGN QUIZ

PROPOSED FUZE FIRST ARMING ENVIRONMENT

Intent-to-Launch signal → Umbilical Disconnect sensed 1 second after ITL signal → Munition Guidance Processor provides confirmation that accelerometer has sensed 10g's acceleration for 8 seconds duration after ITL signal

14. This is not a valid arming environment for fuzing because:

A. Intent-to-Launch (ITL) signal is an event not an environment

B. Umbilical Disconnect is an event not an environment

C. Launch acceleration is not directly sensed by the fuze

D. Both A & B

MIL-STD-1316 F: The Hidden Message

MIL-STD-1316F

FOREWORD

1. This standard is approved for use by all Departments and Agencies of the Department of Defense (DoD).
2. This standard establishes specific design safety criteria for fuzes. It applies primarily to the safety and arming functions performed by fuzes for use with munitions. The safety and arming requirements specified herein are mandatory fundamental elements of design, engineering, production, and procurement of fuzes. Fuzes shall provide safety that is consistent with assembly, handling, storage, transportation, and disposal.
3. This revision has resulted in many changes to MIL-STD-1316E, but the most significant ones include the following:

a. Paragraph on logic functions (see 4.11) is introduced to address the use of logic devices.

b. Requirements for safety qualification of fuzes is changed to the applicable Joint Ordnance Test Procedures (JOTPs).

c. Explosive Ordnance Disposal (EOD) features is updated.

d. Significant changes are made for non-interrupted explosive train control (see 5.3.4) that addresses energy interrupters.

e. The guidance for non-armed condition assurance (see 4.6.6) is modified.

f. Other requirements for maximum allowable electrical sensitivity (MAES) requirements (see 5.6), and munitions that include sub-munitions (see 5.7) are incorporated.

g. New guidance for non-interrupted explosive train control (see 5.3.4) is incorporated.

h. Definitions such as enabling, explosive train, common mode failures, initiator, maximum no-fire stimulus (MNFS) are revised and a definition for common cause failures is added.

i. On fuze safety system (see 4.2), clarification is provided for operation of safety features and arming of submunitions while new guidance is provided for safety architecture distribution and status checks.

j. Modifications to the safety system failure rate (see 4.3) introduces additional evaluation.

k. Explosives listed for inline use (see Table I) approved by all services is revised.

l. New advisory guidance for addressing electronics counterfeit and cybersecurity concerns are referenced (see 6.0).

m. Inclusion of software development procedures is now identified in analyses (see 4.3.1) and in design for quality control, inspection, and maintenance (see 4.4).

n. Clarification is made for design features (see 4.6) for stored energy, compatibility of fuzes, and electrical firing energy dissipation.

o. On electrical and electromagnetic environments (see 4.8), several new JOTPs are introduced.

p. Visual indication requirement is added for bomb fuzes that utilize internal stored energy.