

THE ONE-IN-ONE-MILLION DESIGN
SAFETY REQUIREMENT
REVISITED

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DEDICATION

- THIS PAPER IS DEDICATED TO SYLVIO ODIERNO AND THE SERVICEMEN WHOSE REQUIREMENTS FOR SAFE AMMUNITION HE SO ELOQUENTLY DESCRIBED.

AN OPENING THOUGHT

- “MEMBERS OF THE PUBLIC EXPECT EXPERTS TO UNDERSTAND THAT IT IS HARM TO PARTICULAR INDIVIDUALS THAT CONCERNS THEM ABOVE ALL; THAT SOME WAYS OF FALLING ILL AND DYING ARE MORE FEARED THAN OTHERS”
(MAD COWS & MOTHER’S MILK, 1997)

INTRODUCTION

- THE ONE-IN-ONE-MILLION DESIGN SAFETY REQUIREMENT APPEARS IN FOUR DISTINCT AREAS OF AMMUNITION DESIGN AND USE: ELECTRIC INITIATORS, LAUNCH TUBES, RANGE, AND FUZING SYSTEMS.

SOME RISKS

- ONE-IN-TEN-THOUSAND CHANCE OF BEING KILLED IN A TRAFFIC ACCIDENT EACH YEAR
- US ARMY: ACCIDENT RATE IN FY 98: 3.64 ACCIDENTS PER 1,000 SOLDIERS
- MARINE CORPS: 96 FATALITIES IN FY 01/02

ELECTRIC INITIATORS

- MIL-STD 464 REQUIRES THAT 15% OF THE MAXIMUM NO-FIRE CURRENT FOR BRIDGEWIRE EEDS NOT BE EXCEEDED

LAUNCH TUBES

- STANAG 4110 DEFINES THE CANNON DESIGN PRESSURE AS “THE CHAMBER PRESSURE WHICH SHOULD NOT BE EXCEEDED STATISTICALLY BY MORE THAN ONE ROUND IN ONE MILLION ROUNDS UNDER EXTREME SERVICE CONDITIONS”

LAUNCH TUBES (CONT)

- THE CANNON SAFE MAXIMUM PRESSURE CURVE IS DEFINED AS “A PRESSURE VS. LOCATION CURVE WHICH, IF EXCEEDED, COULD RESULT IN THE OCCURRENCE OF PERMANENT DEFORMATION”

LAUNCH TUBES (CONT)

- THE MARGIN OF SAFETY IS “THE DIFFERENCE BETWEEN THE CANNON SMP CURVE AND CANNON DP CURVE AT ANY POINT ALONG THE TUBE”

RANGE SAFETY

- STANAG 2401 AND US ARMY AR 385-63 REQUIRE THAT THE PROBABILITY OF A PROJECTILE OR FRAGMENT APPEARING IN THE LOCATION OF A PERSON A RANGE DURING PEACETIME BE 0 MORE THAN ONE-IN-ONE-MILLION

FUZING SYSTEMS

- STANAG 4187 STATES: “THE PROBABILITY OF ARMING BETWEEN MANUFACTURE AND START OF THE ARMING SEQUENCE SHALL NOT EXCEED ONE IN A MILLION”
- WHY?
- THE MINUTES OF A 1965 MEETING AT PICATINNY ARSENAL EXPLAIN

FUZING SYSTEMS (CONT)

- THE MEETING WAS HELD TO REVIEW US ARMY MUCOM REGULATION 705-11 WHICH REQUIRED “TWO INDEPENDENT SAFING FEATURES”

FROM THE MEETING MINUTES:

- “ A PROPER SAFETY OBJECTIVE WAS ONE THAT GAVE A REASONABLY GOOD CHANCE THAT NO DEATHS WOULD OCCUR IN FIRING THE STOCKPILE OF AN ITEM

FUZING SYSTEMS (CONT)

- “WITH TWO INDEPENDENT SAFING FEATURES, WE COULD STAND UP TO ONE FAILURE IN 2500 EACH AND STILL MEET A ONE-IN-FIVE-MILLION FAILURE RATE
- “ WE HAVE TO MORE SO-CALLED ‘FOOLPROOF’ DESIGNS THAT DON’T RELY ON INSPECTION TO PROVIDE ADEQUATE SAFETY

THE ROLE OF PRECLUSION OF INJURY

- PRECLUSION OF INJURY IS NOT THE LIMITING CRITERION;
- LIMIT CRITERIA ARE OBJECTIVELY MEASURABLE PRECURSORS TO INJURY

DISCUSSION

- THE ONE-IN-ONE-MILLION DESIGN REQUIREMENT, WHILE ACHIEVABLE, EXCEEDS BY ORDERS OF MAGNITUDE RISKS ACCEPTED IN DAILY AND MILITARY LIFE;
- WHY?

DISCUSSION (CONT)

- SOLDIERS CAN ACCEPT THE RISK OF BEING SHOT AT; THEY SIMPLY WON'T ACCEPT BEING HURT BY INADVERTENT FAILURES OF THEIR WEAPONS

RECOMMENDATIONS

- NATO AOP 15, NATO'S GUIDE FOR THE CONDUCT OF S³ ASSESSMENTS SHOULD INCLUDE A DESCRIPTION OF THE ORIGIN AND BASIS FOR THE ONE-IN-ONE-MILLION REQUIREMENT
- SIMILARLY, WAIVERS TO THE REQUIREMENT SHOULD REFLECT ITS BASIS

A CLOSING THOUGHT

- “...IF FUZE DESIGNERS GIVE EQUAL CONSIDERATION AT THE INCEPTION OF A DESIGN TO THE SAFETY AS WELL AS TARGET FUNCTIONING REQUIREMENTS, FUTURE EMBARRASSMENT AND/OR GRIEF WOULD BE AVOIDED” (SYLVIO ODIERNO, 1965)