Safety and Interim Fatigue Testing of a Domestic RPG System

NDIA Armament Systems Forum
22 APR 2015

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Photo courtesy of Airtronic USA, Inc.
Briefing Outline

• Background
• Objective, Scope, & Constraints
• Project Tasks
  ▪ Charge Establishment Tests
  ▪ Proof Tests
  ▪ Interim Fatigue Firing Tests
  ▪ Drop Tests
• Summary
• Future Activities
Background

• US forces desire the capability to train with RPG systems
  ▪ Limited availability of ammunition and launchers
  ▪ Desire higher level of confidence in system safety

• Airtronic USA, Inc. produces an American-made RPG launcher, Model 7
  ▪ Uses wrought vs. cast steel barrel (AISI 4140 / 4150)

• USG required suitable testing performed and documented before approving limited safety release
Objective, Scope & Constraints

• Objective
  ▪ Develop data relevant to a limited safety release for the Airtronic Model 7 grenade launcher

• Scope
  ▪ Perform inspections and proof tests on at least two launchers
  ▪ Establish Interim Safe Fatigue Life estimate via live fire testing
  ▪ Perform drop tests per MIL-STD-810G

• Constraints
  ▪ Time (approx. 1 month)
  ▪ Ammunition availability
Charge Establishment Tests

• ATEC recommended using ITOP 3-2-829, Cannon Safety Test as a guideline

• Proof tests require a proofing round
  - What pressure? Limited pressure data (i.e., \( P_{\text{hot}} + 3\sigma \) unknown)
  - It was agreed that Battelle would develop a double-pressure proof test to verify launcher integrity (i.e., \( P_{\text{peak}} = 2 \times P_{\text{nominal}} \))

• Launcher with pressure instrumentation ports was available but, there was concern repeated high-pressure tests to establish proof charge would cause failure

• Battelle designed and fabricated heavy-walled Charge Establishment Fixture for repeated high-pressure tests
Charge Establishment Fixture (CEF)

• CEF allows numerous high pressure tests
  ▪ Mitigates concern about overstressing threaded ports in instrumented launcher
  ▪ Two pressure ports to capture P-t data
  ▪ Available for development of proof rounds for heavier projectiles

• Surrogate launch package
  ▪ Inert ballistic slug (no energetic material launched downrange)
  ▪ Same mass as PG-7 family (2 kg)
  ▪ Same exterior profile as PG-7 to emulate launch blow-by flow
  ▪ Percussion primer, 10 g FFFg black powder in piccolo tube, commercial propellant for ejection charge
Charge Establishment Setup

- CEF with surrogate launch package
- Fiducial board for high speed video
- Soft catch box (sand filled)
Charge Establishment Data

- Instrumented launcher with PG ammo (top)
- Instrumented launcher and CEF with surrogate launch package (bottom)
  - Good agreement between PG ammo and surrogate launch package
    - Peak pressure
    - Pulse width
  - Excellent agreement between CEF and launcher
Proof Tests

- Double-pressure proof test to verify launcher integrity
- Surrogate launch package fired into soft catch box (sand)
- Magnetic particle and bore gaging inspections before and after proof test – no issues
Interim Fatigue Firing Tests

• Series of live firings to assure no low-cycle fatigue issue
  ▪ 150 tests fired in 6 days
  ▪ Peak firing rate: 8 per hour for several hours
  ▪ Average rate: ~5 per hour

• Magnetic particle inspection after series showed no damage, wear, or cracking anywhere in launch tube
Drop Tests

• Conducted IAW: MIL-STD 810G1 Method 516.7 Procedure IV: Tactical Transit Drop
  - Unpackaged Handling Test for Man Carried Munitions
• 1 series of 3 drops each on 5 different sides of the system
  - Ventral (grip and firing mechanism)
  - Lateral (+90° right hand line of action)
  - Fore Edge-Ventral
  - Aft Edge-Dorsal
  - Nose
• Used surrogate launch package (primer only)
Summary

- Fabricated Charge Establishment Fixture for development of double-pressure proof round
- Developed double-pressure proof round for verifying launcher integrity
- Established interim fatigue life (≤150 rounds)
- Passed drop test series
- All tests complete in less than one month
- Limited safety release for use by US troops subsequently granted based on the data generated in this effort
Future Activities

• Testing of Airtronic Model 7 launcher by US troops in various experiments
• Environmental testing of Model 7 (i.e., dust, vibration, accuracy, etc.)
• Development of proof rounds for heavier projectiles
• Extended live fire testing to establish fatigue life (1000+ rounds)
• Similar testing of lightweight version (Model 777)
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