Shipboard Magazine Temperatures

Susan Peters
Jason Budd
John Norton
Outline

- Objective
- Background
- Study Design
- Results
- Recommendations
Objective

- Determine actual ship storage conditions for 5” US Navy gun ammo
- Determine if current practice of charge weight assessment at 90°F (31°C) is reasonable.
- Recommend changes if warranted.
Background

- Powder is proofed at 90°F
- Historical study showed magazines near 90°F
- Magazines believed to be ~70°F, but proofed at 90°F for safety’s sake
- 1.2 fps/°F velocity loss
Background

- Search revealed study was from before WWI!
Study Design

- Needed data from all ships that mount 5” guns – cruisers and destroyers
- Message sent to type commanders requesting one year’s worth of magazine temperature logs
- Max & min temperature recorded daily
The Ships

- Cruisers & Spruance class destroyers
- 2 Mk 45 gun mounts
  - 3 magazines
    - 1 forward
    - 2 aft
The Ships

- Arleigh Burke and Spruance class Destroyers
- 1 Mk 45 gun mount
- 1 magazine forward
The Respondents

- All respondents from Pacific Fleet
- 9 respondents in all
  - 5 cruisers
  - 2 Spruance destroyers
  - 2 Burke destroyers
- 9/81 US Navy ships mounting Mk 45 – better than 10% of relevant Fleet
The Data

- Handwritten, monthly logs
- Record max & min temperature daily
  - Some gaps indicate empty magazines during maintenance in port
- Data entered into spreadsheets and plotted
USS PORT ROYAL CG73 MAGAZINE TEMPERATURES

AVERAGE TEMP = 71
MAX TEMP = 80
MIN TEMP = 58
STD DEVIATION = 4.7
Results

USS MOBILE BAY CG53 MAGAZINE TEMPERATURES

Average Temp = 65
Max Temp = 96
Min Temp = 30
Std Deviation = 7.4
Statistics

- “Average” temperature = 70°F
- Data are max and min, not time average temperature
- Extremes could be result of opening hatch in extreme weather
- Magazines tend to be cool rather than hot
Data Analysis

- Temperature excursions correlate to seasonal temperature swings or deployments
- Forward magazines cooler than aft
  - Closer to seawater
  - No heated spaces forward, only aft
- Magazines are not heated, only cooled
Recommendations

- Design operating temperature range of 20 to 120°F is reasonable.
- Charge weight assessment should be done at 70°F to avoid excess corrections and velocity loss.
- Future ship designs should include capability to warm magazines.