

Shipboard Magazine Temperatures



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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



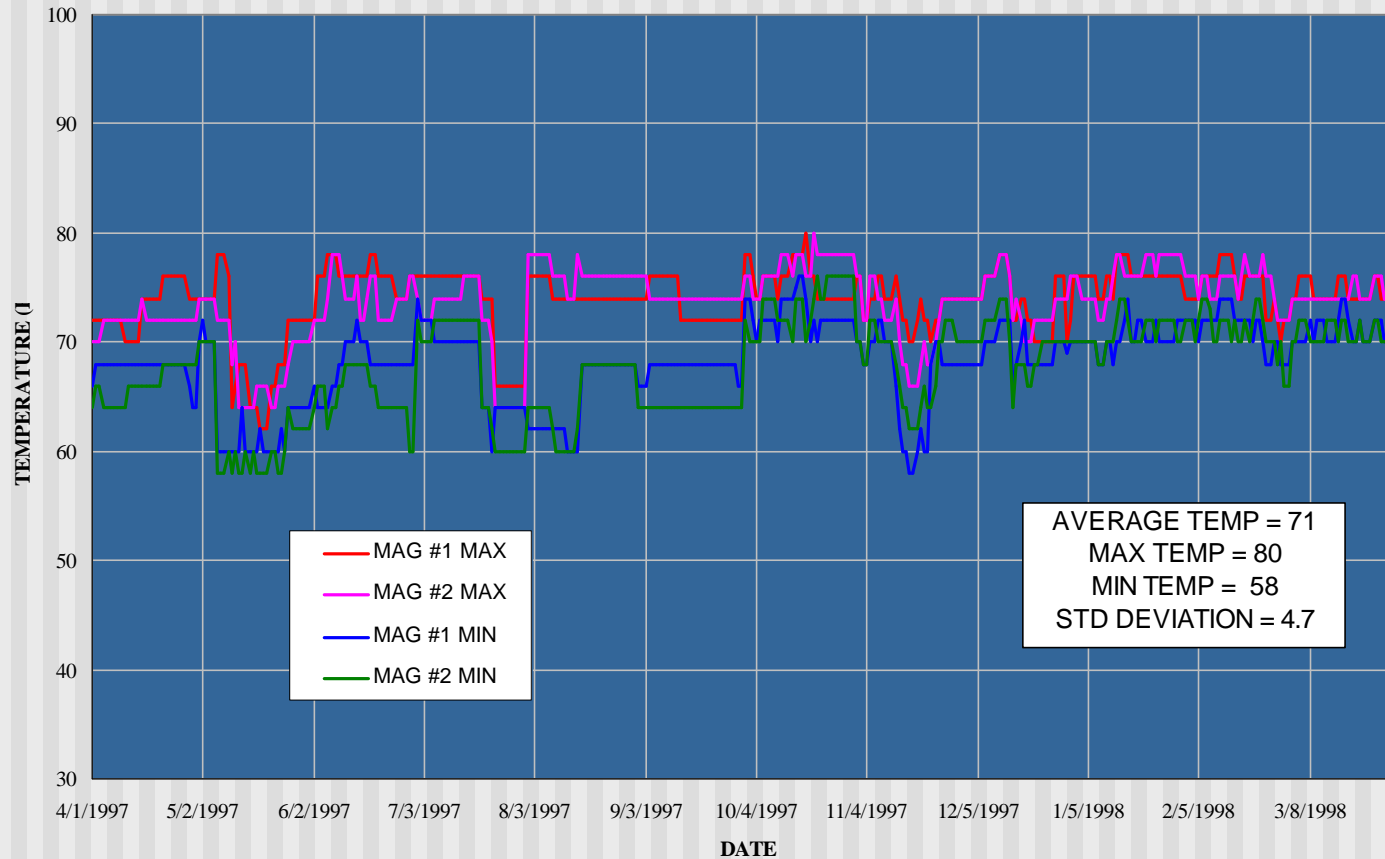
The Data

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

Results



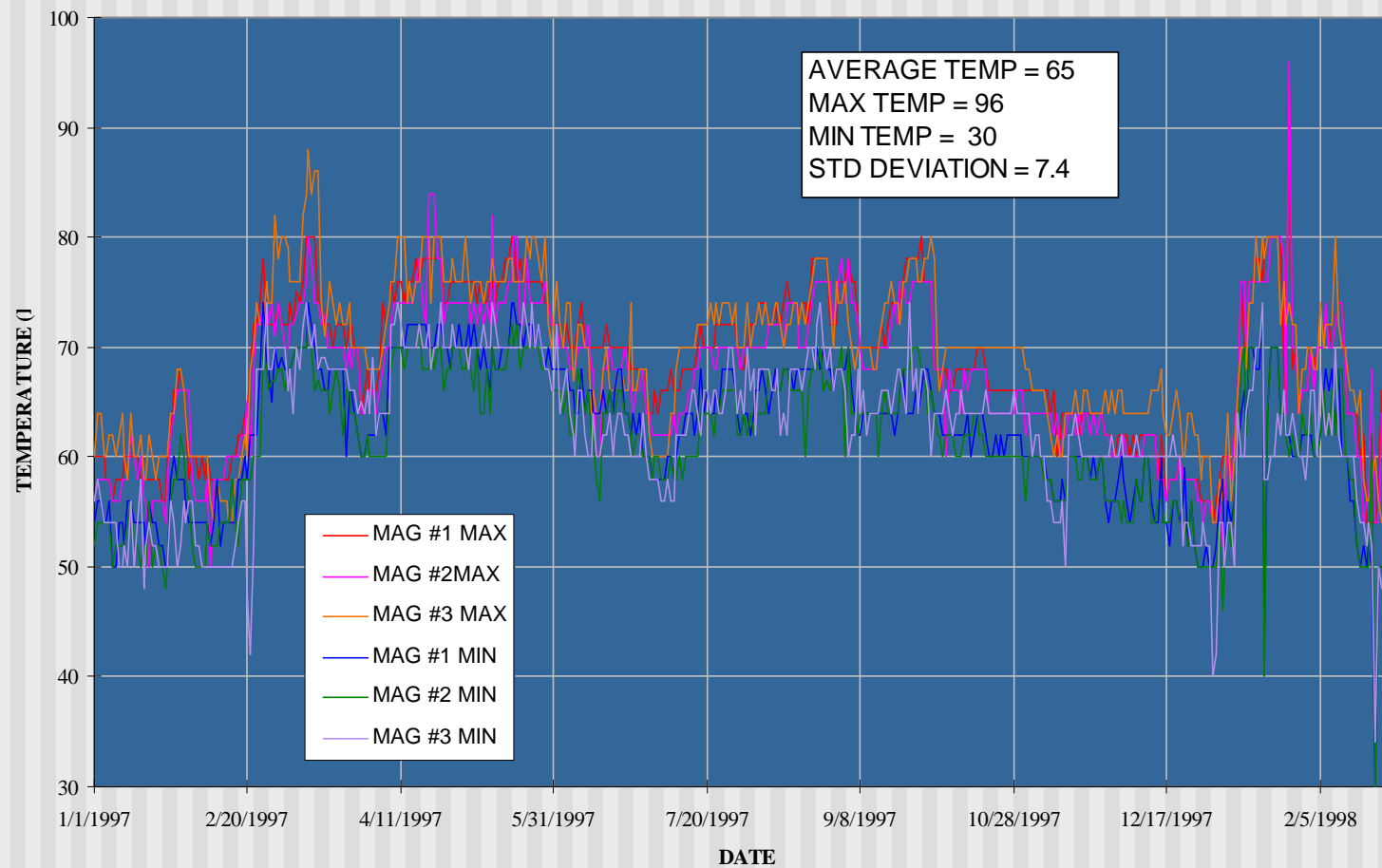
USS PORT ROYAL CG73 MAGAZINE TEMPERATURES



Results



USS MOBILE BAY CG53 MAGAZINE TEMPERATURES



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