

# Advances in Holiday Detection Using Fluorescent Coatings

Paul D. Gossen  
National Surface Treatment Center

RUST 2005  
22 June 2005



# Presentation Overview

- U.S. Navy Goals
- Optimizing Visual Inspection
- Optical Holiday Detector
- Summary

# U.S. Navy Goals

- Consistent 20 year tank coating life
- High quality coating application
- Data-driven application oversight

# Visual Inspection

- U.S. Navy tanks
  - Small spaces
  - Complex geometry
- Holiday detection
  - Done by visual inspection
  - Non-line-of-sight with mirror and flashlight

# Fluorescent Coatings Improve Visual Inspection

- Fluorescent primer emits intense color under UV light
- Dramatically enhances defect contrast
- Wet or cured coatings
- Implemented in MIL-PRF-23236C

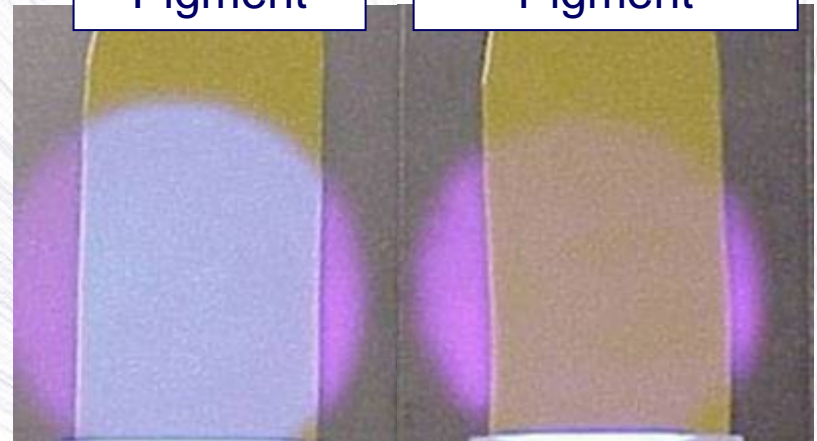
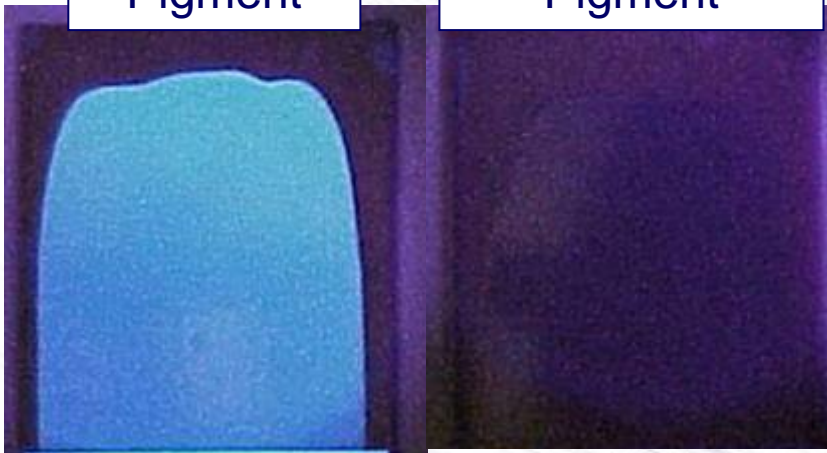
# Fluorescent Primers Under UV-A Light

Fluorescent  
Pigment

No Fluorescent  
Pigment

Fluorescent  
Pigment

No Fluorescent  
Pigment



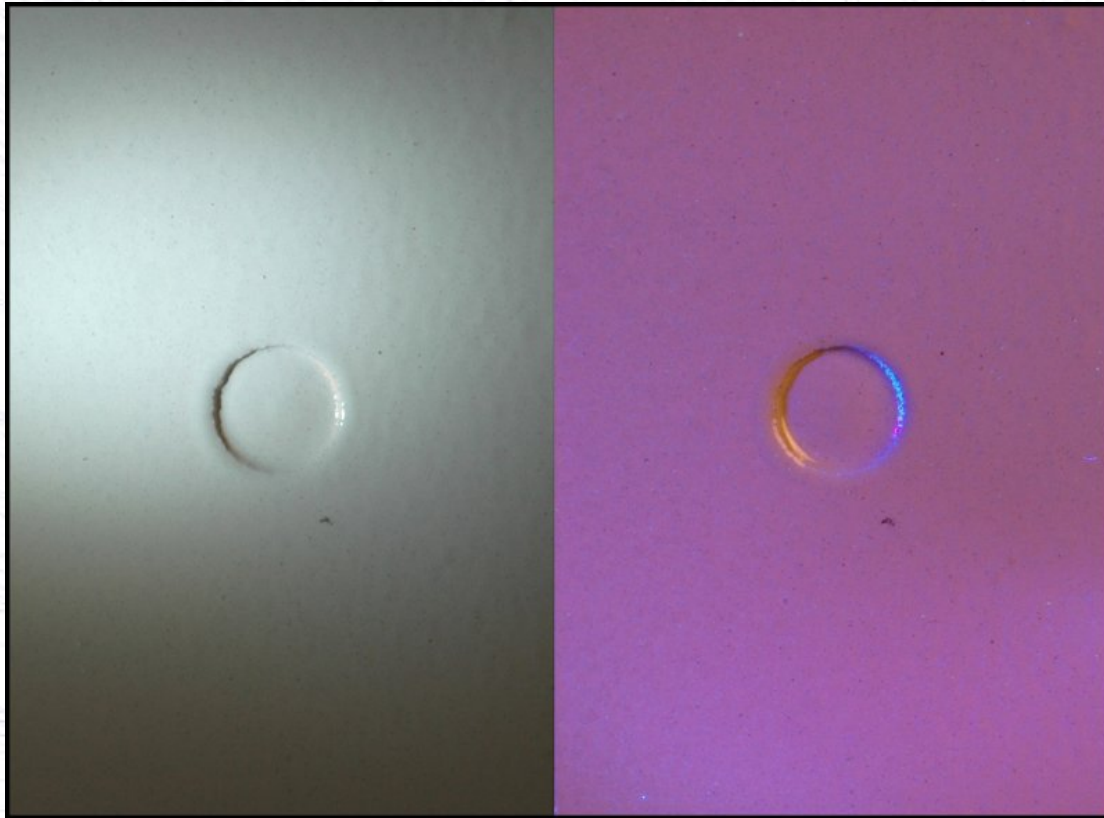
DARK ROOM

WELL-LIT ROOM

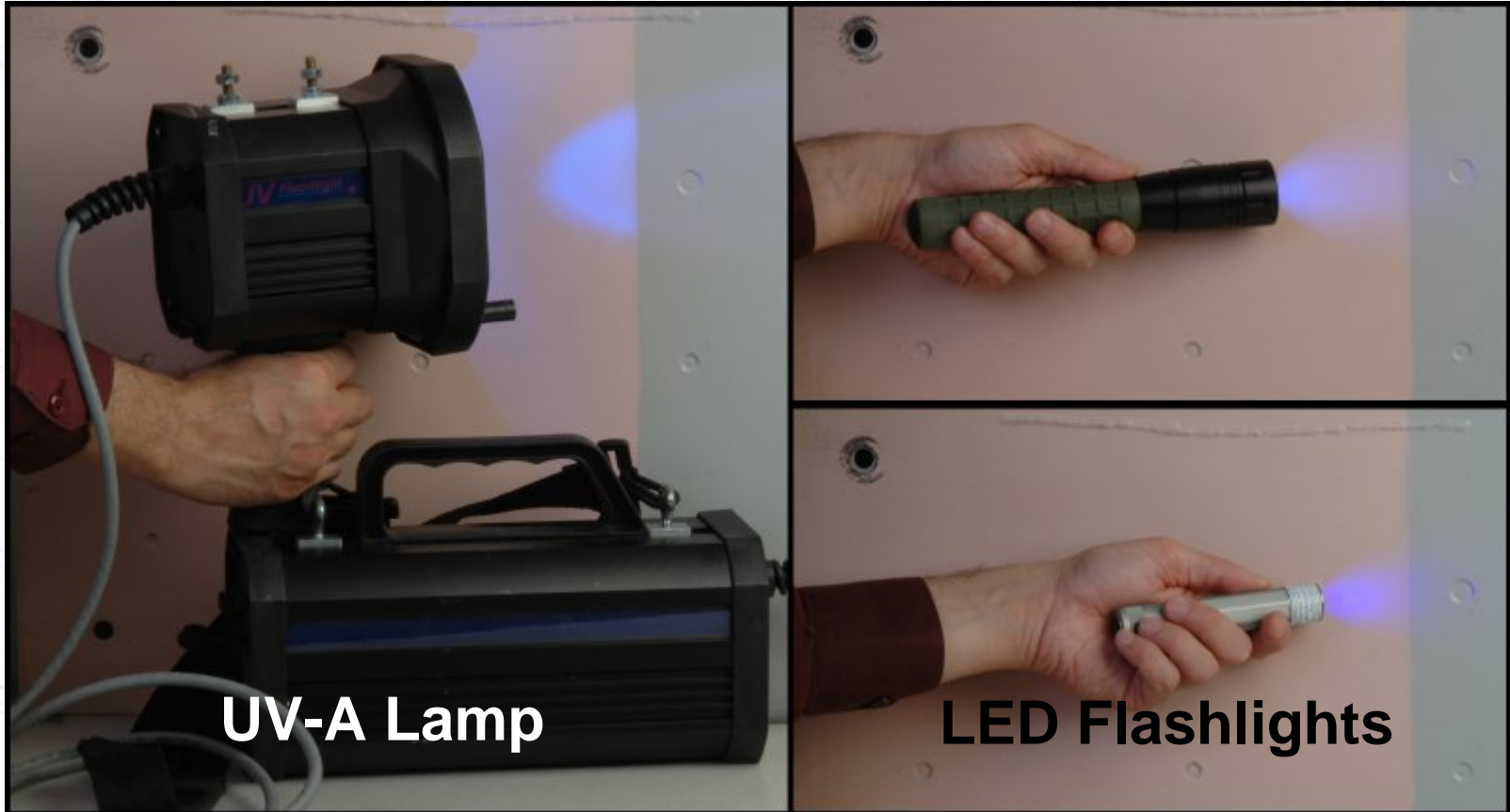
# Shipyard Inspector Results with Fluorescent Primer

- Enhances visual inspection
  - Enhances contrast for holidays
  - Makes subsurface bubbles visible
  - Makes uneven application visible
  - No flashlight glare on glossy coatings
- Finds defects that are invisible under white light inspection

# Topcoat Holiday in Pit



# Advances in Light Sources



**UV-A Lamp**

**LED Flashlights**

# LED Flashlight

- Advantages

- Compact and light
- Low cost
- Rugged
- Improved eye safety

- Challenges

- Different wavelength than UV-A lamp

# Optimize Fluorescent Coatings

- Specify purple LED flashlights
  - Eye safe 405 nm to 410 nm
  - Cheaper than UV
  - Low human eye sensitivity
- Choose green to yellow fluorescence
  - Best human eye sensitivity
  - Low cost pigments

# Optical Holiday Detector

# Holiday Detection Challenge

- Improve holiday detection ...
  - Along weld beads
  - Not line-of-site to spray gun or inspector
- Tank inspector needs ...
  - Compact, lightweight, portable, rugged
  - No distractions
  - High productivity
  - Instant feedback

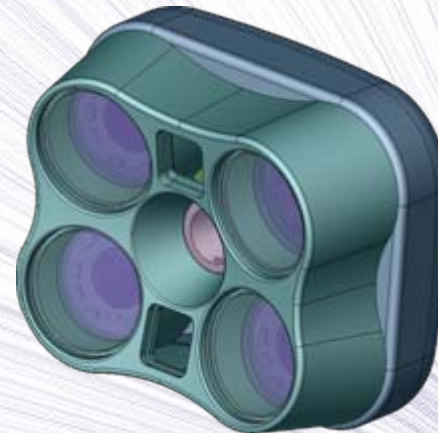
# Optical Holiday Detector



**Analyzer**



**Goggle  
Mounted Display**



**Sensor Head**

# Holiday Detector Speed and Resolution

- Productivity = 150 sq.ft./min.
- Resolution = 0.5 mm pinhole holiday
- On detection of holiday
  - Audio beep
  - Display “flash”

# Production Status

- Units available for field testing September
- Commercial units available 2006

# Summary

- Extend coating life with improved QA
- Fluorescent primers enhance holiday detection
- LED flashlights create inspector-friendly fluorescent coating systems
- Developed optical holiday detector
- Compact field hardware is under construction

