Guidance Integrated Fuze

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GIF Overview

• GIF Program is a Technology Demonstration Program Initiated by OSD AT&L in 2003

• Package Guidance, Control, & Navigation into NATO Standard Short Intrusion Fuze
  – “JDAM” for Artillery
  – Family of Fuzes

• Broad Area of Applicability
  – Designed for 155mm, 105mm, 5-Inch, 120mm Artillery
  – Adaptable to 81 & 120mm Mortars, 2.75” Rocket
Notional GIF CONOPS

- Ballistic Solution
- Initialize Fuze

- Unguided Impact
  - Predict Miss
  - Deploy Controls
  - Steer to Target

- Guided Impact
  - DeSpin Nose (Lift-GIF only)
  - Acquire GPS

- GPS Satellites
GIF/VariPitch (VP) Design
(PGK in NATO/EPIAFS Form Factor)

GIF/VP Advantages:
• Simpler than Navy “Lift-GIF” yet more robust in terms of Jamming and Reliability.
• ~$1K Less Expensive in Production
• Capable of a 15m to 20m CEP.
• Applicable to All Ammo Types.
• Meets or Exceeds PGK Inc 1/2/3 Requirements.
• Leverages All Previous Navy-GIF Developments except the Roll Brake and Bearing Assemblies.
GIF VariPitch Control Modes

Drag "Throttled" at 10% to 50%

Mode 1
10% Drag Increase

Anti-Roll Spin

Mode 1

Pro-Roll Spin

Mode 1

Drag "Throttled" at 60% to 100%

All Drag Modes Have Spin Control

Mode 2
50% Drag Increase

Mode 3
60% Drag Increase

Mode 4
100% Drag Increase

Drag Panels Don’t Rotate

Drag Mode States Generally Increase as the Time to Impact Decreases
Guided Fuzing T&E

• GIF #6, #7
  – Gunfire tests from 155m Howitzer @ NSWCDD
    • Nov 2006, Apr 2007
  – Consistent performance
    • First rounds with complete telemetry
    • Repeatable results, allowed better fault diagnosis
Guided Fuzing T&E

• GIF #6, #7 (cont’d)
  – Test results
    • Full system startup
    • Initial de-spin and nose control
    • GPS acquisition, track, and navigation solution
      – T+34 sec -> impact
    • Canard covers did not deploy
    • Guidance solution established, correct control commands issued
      – Waffle canards remained constrained in fuze
Miniaturized GPS & AJ

• No Existing Product Could Meet GIF Requirements
• Awarded Contract to Mayflower Communications for Development of GPS Receiver w/ Anti-Jam
  – Low Cost (< $500)
  – Low Power (< 1W)
  – Small Size (< 2 in²)
• Phased approach:
  – C/A Version w/ FPGA
    Available Now!!
  – 4 Channel AJ Available Winter 2008
  – P(Y) w/ SAASM
    Single Die ASIC (TRL 6)
    Available Fall 2008
• Not GIF-Centric
  – One Product, Many Applications
GPS SAASM T&E

• C/A Code FPGA Based Receiver
  – Air Gun Shock test – April 2007
    • 20,000 g; nominal performance
  – Gunfire Test – April 2007
    • Packaged into Electronic Test Fuze (ETF) on M795 round
    • Fired from M198 Howitzer at 7W
    • Receiver tracked multiple satellites

• P(Y) Code SAASM Test Chip #1 rec’d Feb 2007
  – Tracking P(Y) code in GPS simulator tests
Path Forward

• Lift-GIF “Return-to-Flight” upgrades underway
• Vari-Pitch subsystem qualification testing & guided flight testing
• Guided fuzing development will cease after 2007 w/o additional sponsorship
  – 80% funding cuts in FY08 & FY09
• Miniaturized GPS P(Y)-Code SAASM development & qualification will continue through FY09
  – Working with sponsors to secure funding for TRL 7 ASIC