Guidance Integrated Fuze

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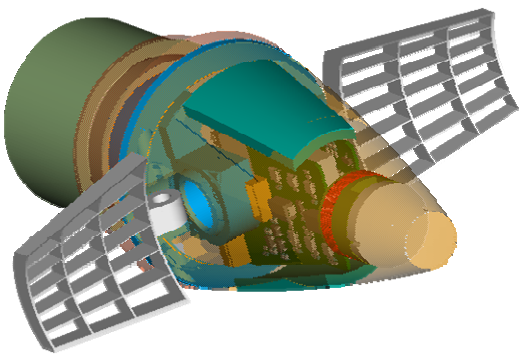
NDIA 51st Annual Fuze Conference

Nashville, TN

22-24 May 2006



Luke Steelman
Project Manager
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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

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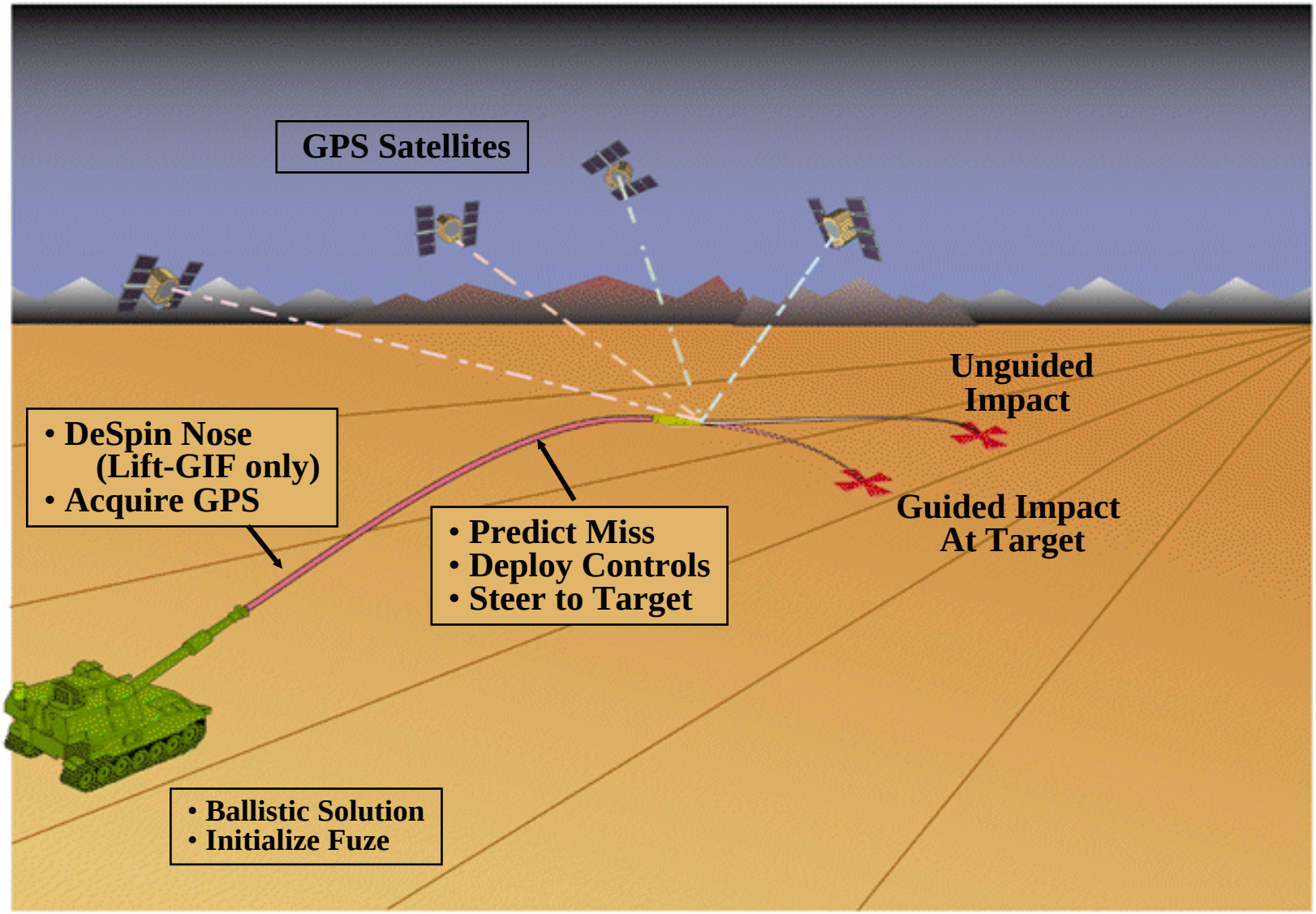
Notional GIF CONOPS



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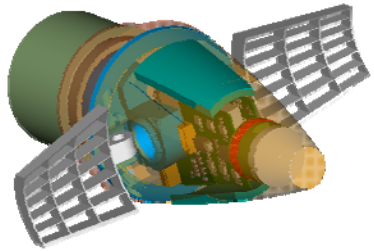
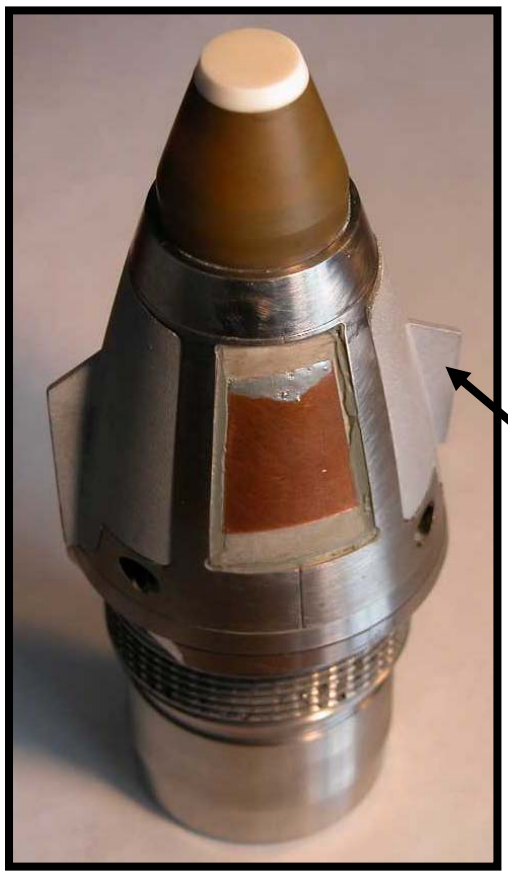
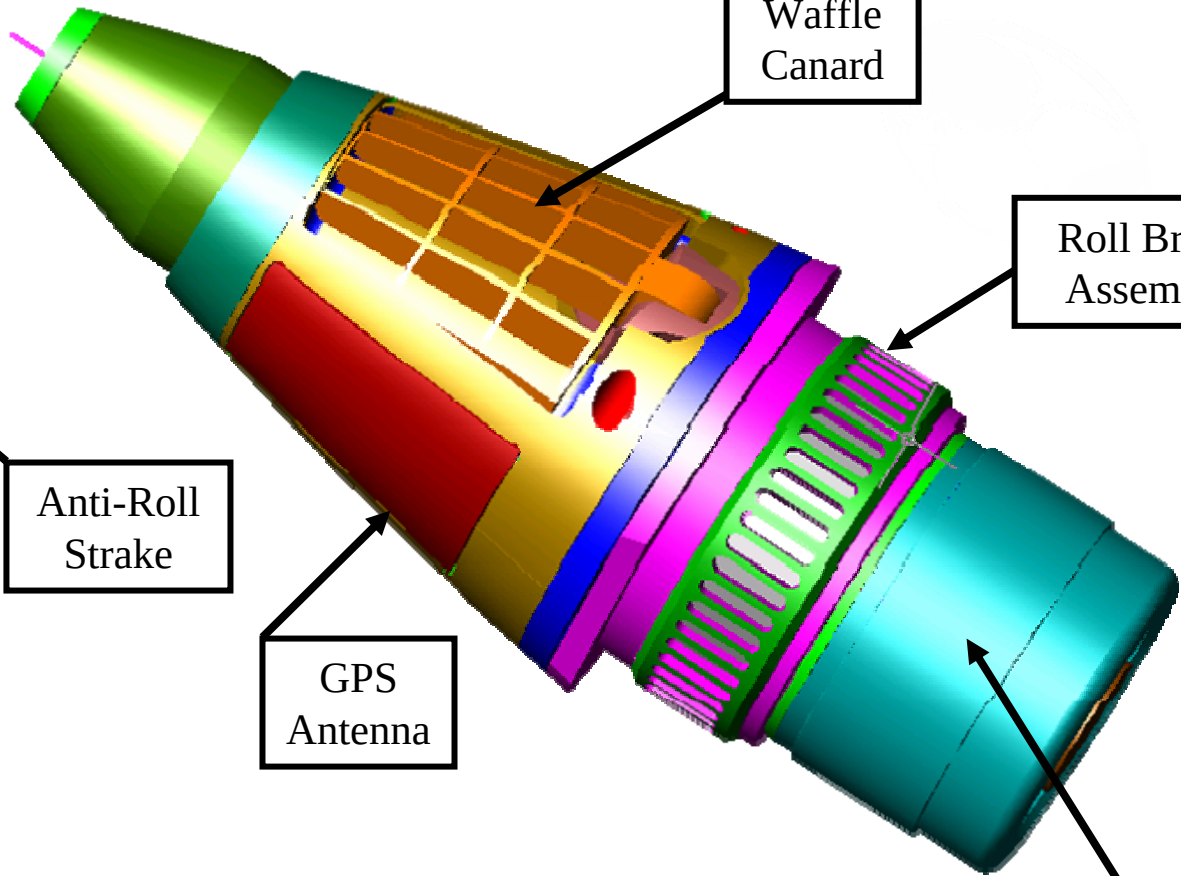
Lift-GIF Design







Waffle Canard

Roll Brake Assembly

Anti-Roll Strake

GPS Antenna

Explosive Train
OR
TM Support Housing

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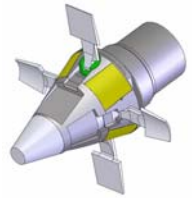
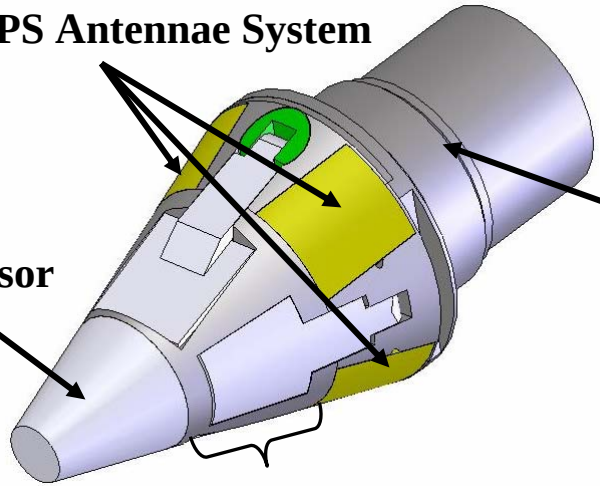
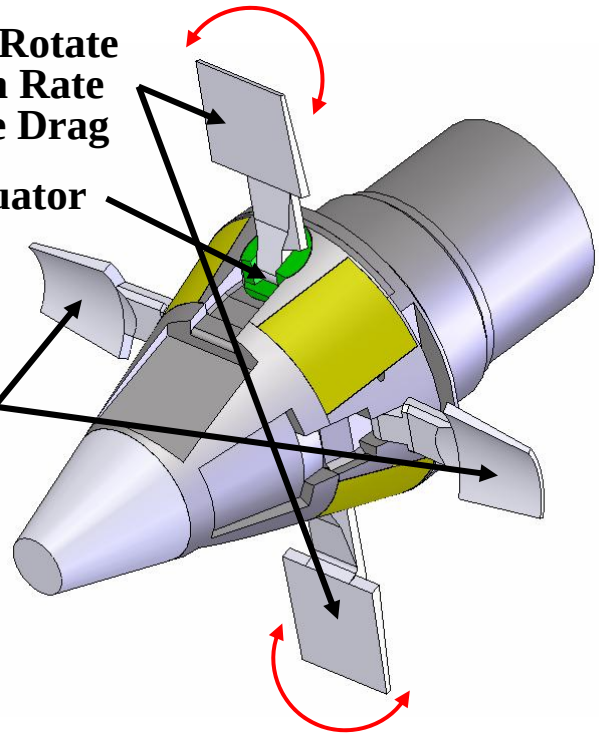
GIF/VariPitch (VP) Design
(PGK in NATO/EPIAFS Form Factor)



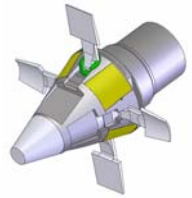


GIF-Based GEU with Advanced Anti-Jam and Backup "Command Mode" using PTS if GPS is Denied



<u>GIF/VP Advantages</u>:
- **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



Mode 1
10% Drag
Increase

Mode 1

Mode 1

Anti-Roll
Spin

Pro-Roll
Spin

Drag
"Throttled"
At 10% to 50%

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

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Guided Fuzing T&E

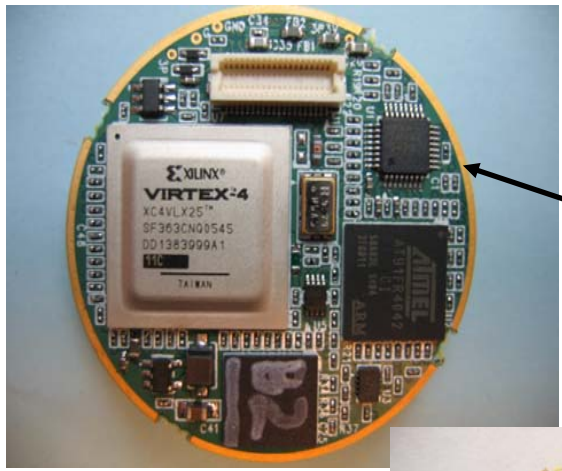
- GIF #6, #7
  - Gunfire tests from 155m Howitzer @ NSWCDD
    - Nov 2006, Apr 2007
  - Consistent performance
    - First rounds with complete telemetry
    - Repeatable results, allowed better fault diagnosis

Guided Fuzing T&E

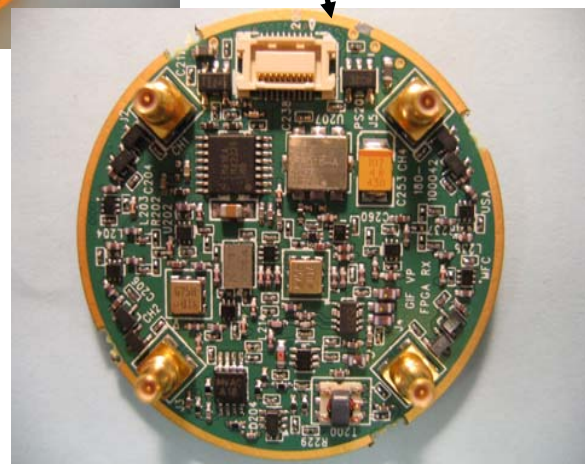
- GIF #6, #7 (cont'd)
  - Test results
    - Full system startup
    - Initial de-spin and nose control
    - GPS acquisition, track, and navigation solution
      - T+34 sec -> impact
    - Canard covers did not deploy
    - Guidance solution established, correct control commands issued
      - Waffle 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 in^2)
- 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



40mm diameter
(VP Form Factor)



GPS SAASM T&E

- C/A Code FPGA Based Reciever
  - 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

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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