United Defense Course Correcting Fuze for the Projectile Guidance Kit Program

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The Need for Accuracy



Direct Fire

-Relatively good accuracy, typically within 1m @ 1,000m





Indirect Fire

-Accuracy may be as poor as 300 m CEP @ 30,000m

- Longer times of flight
- The projectile actually "flies" in the atmosphere
- High altitude trajectories influenced by wind & temperature
- Rocket assist extends range but degrades accuracy

300 m

The Need for Accuracy (Cont.):

 Conventional efforts to improve artillery accuracy have reached the point of diminishing returns

Automatic gun pointing
Better / more frequent
meteorological data
Muzzle velocity sensing and
feedback

 The Air Force demonstrated dramatic improvement in bombing accuracy with Joint Direct Attack Munition (JDAM)

-A kit with GPS sensor and steerable fins which can be applied to legacy "dumb" bombs





MK83

WARHEAD

Corrector Concept of Operation



Round is aimed long and to the right of the target.

- Drag brakes are deployed to correct the range.
- Spin brakes are deployed to correct cross range drift.

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Approach: Projectile Guidance Kit: Course Correcting Fuze (CCF)



Approach: - Packaging the Spin Brakes

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Approach: Stepwise Design, Simulate, Build, Test



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Development Team

United Defense: 128 Fuzes Built, 110 fired, including zone 8s. Verified stable, in-flight deployment and aerodynamic corrections. Developed fire control algorithms for brake deployment scheduling.

> Bofors Defence: Aerodynamic designs, Sub-scale Wind Tunnel, Access to Full Scale Wind Tunnel.

> > Rockwell Collins: GPS receiver and antenna. Fired to zone 8s on spinning Projectiles.



BT Fuze Products: Non-Developmental Components and Final assembly.

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- Testing was conducted on March 30th and 31st, 2005 at YPG in Yuma, Arizona to demonstrate CCF functionality in a live fire environment. The following preliminary results were obtained:
- Achieved fuze structural integrity under low zone firing
- Achieved communication with GPS constellation
- Achieved on-board, real-time computation of GPS/control system solution
- Verified range-brake (main/vernier) performance
- On-board computation of corrections Analysis ongoing and further testing being planned

We have demonstrated a simple, low-cost artillery Projectile Guidance Kit that:

- Utilizes GPS position and velocity feedback
- Calculates ballistic trajectory solution in "real-time"
- Allows range and cross range correction
- The path forward is to further refine the fuze for tactical applications