U.S. Navy Spike Missile System: A New Generation of Miniature Precision Guided Weapons

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Background

- Engage “asymmetric” aggressors in complex urban and rural environments; weapons have to be high precision, low collateral damage systems to minimize civilian victims

- To meet these needs, a new class of missile system is necessary. It must be a modular, cheap, lightweight, high precision missile system

- This paper will cover system, technology and design approach aspects of the USN Spike missile project, an innovative, low cost, precision guided missile system

How We Are Doing It

- Spike treated like a commodity
- Development
  - Extensive warfighter interaction and validation
  - 80% vice 100% solution and affordable (get most of the capability to the warriors ASAP)
    - Cost is highest priority design factor
    - Weight & Volume
    - Performance
  - Navy - Industry partnership from the start
    - Navy laboratory team leads system development
    - Industry partner engineers for high volume manufacturing
- Manufacturing
  - Navy owned data package
  - System Assembler (No traditional prime contractor)
    - No missile manufacturing expertise required
    - 2nd & 3rd tier (defense) contractors
  - Smart use of COTS in a military application
    - Modular design
    - Add additional capability through spiral developments
    - Production line set up for change

Programmatic Goals

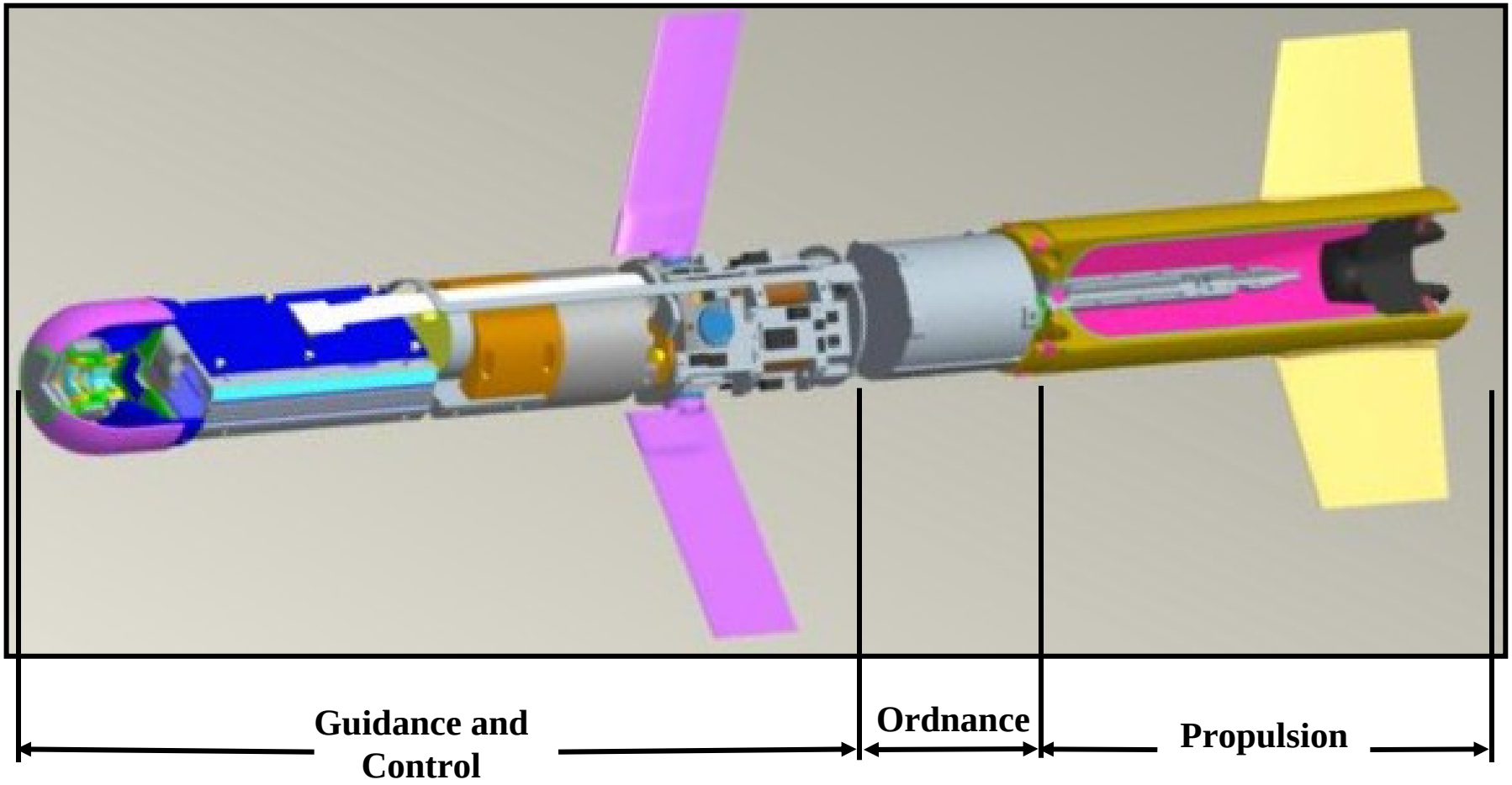
	Spike	Typical
■ X10 reduction in unit cost	$5K	>$75K
■ X5 reduction in development cost	$75M	$0.5-1.2B
■ X3-4 reduction in SDD time	2-3 years	12-16 years

What is Spike?

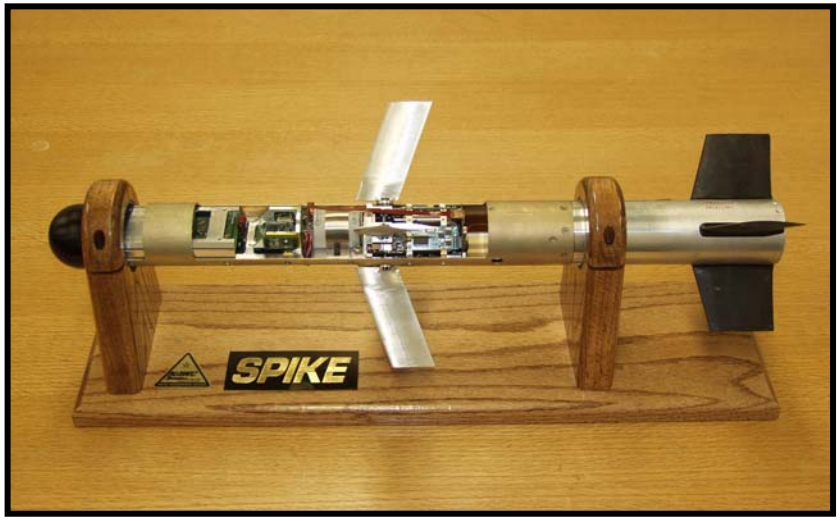
Small fire and forget precision guided missile system

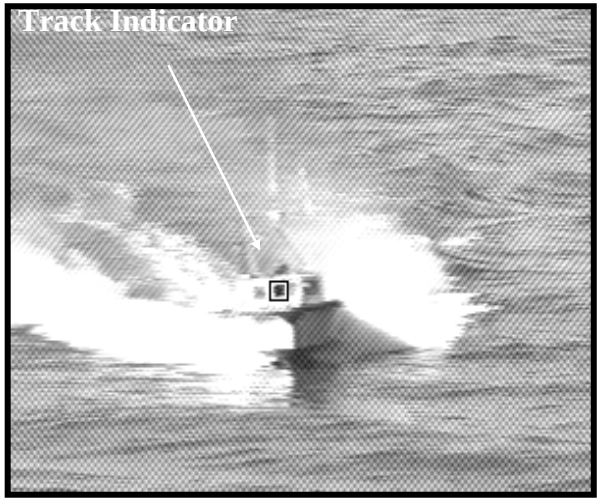
- Shoulder, tactical UAV, or UGV/boat/ship launched system
- General purpose electro-optical (EO) seeker
- Lightweight system - goal of 5 lb./missile
- Smart use of COTS in military application
- Affordable - goal - $5K/missile
- "80% solution"

Modular System Design



Spike Missile Performance





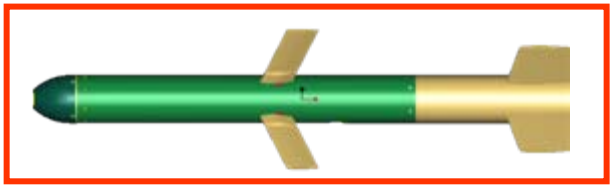
- Low Cost Highly Effective Precision Guided Missile
  - Total weight ≈ 5 lbs
  - Warhead ≈ 1 lb EFP
  - Range ≈ 2+ miles
  - Max flight velocity ≈ 800 ft/sec
  - Cost ≈ $5K AUPC
  - Seeker EO or Laser spot

- Highlights
  - Fire and Forget
  - Fire from enclosure - minimal backblast
  - Precision guidance ideal for littoral and urban environments - minimizes collateral damage
  - Designed for flexible manufacturing
  - Ready for production in 2 years

Spike Warhead Performance

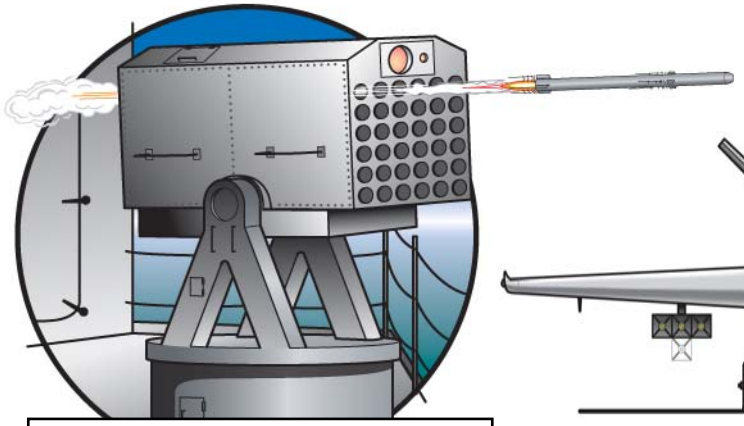
- 1 lb. explosively formed projectile warhead
- Copper liner, magnesium and steel fragmentation wrap

Spike Launchers

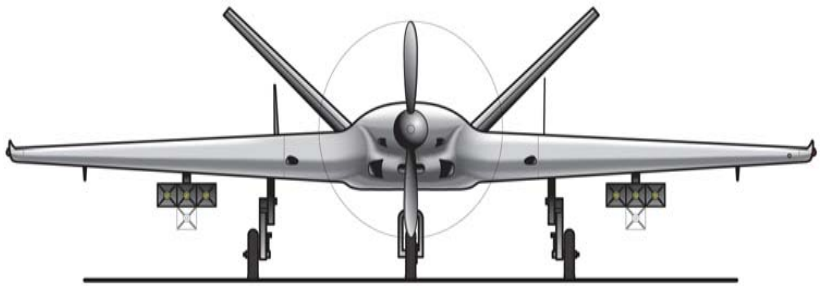


- Common missile
- Multiple launchers

Shoulder



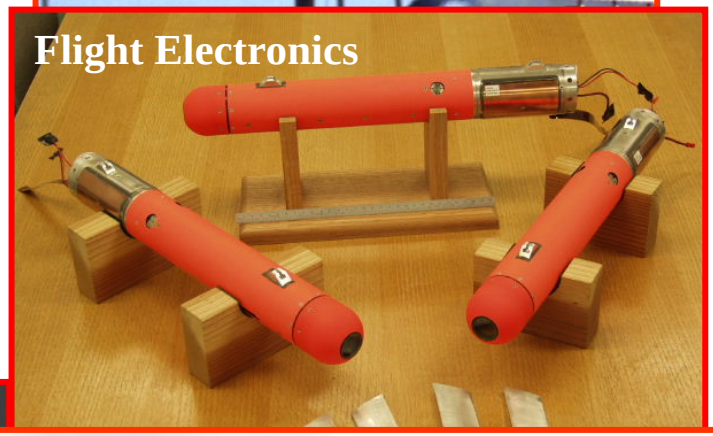
Remotely Controlled Box



TUAV

Accomplishments

- Wind tunnel tests
- Target acquisition/track testing
- Preliminary rail launch test firing
- Separation Control Test Vehicle (SCTV) missile firings (3)
- Separation Control Test Vehicle (SCTV) missile firings (2)
- Four warhead lethality tests
- Guided missile test



Asymmetric Threat Target Set

- Target characteristics
  - Large numbers
  - Low cost
  - mobile
- Targets
  - Small boats
  - Un-armored vehicles
  - Lightly armored vehicles
  - Machine gun emplacements
  - General aviation
  - Helicopters

Program Measures of Effectiveness

- Cost
  - Live fire training
  - Deploy with large numbers
  - Recurring, non-recurring, life-cycle
- Tactical utility
  - Can get it to the fight-weight, volume
  - Value
- Performance
  - Precision guided
  - Low collateral damage
  - Engage maneuvering targets

Cost Drivers

- Control requirements
  - Adequate performance not perfect
- Technology availability
- Control system complexity drivers
  - Lock-on-before-launch (LOBL)
  - Resolved targets
  - Gunner verification of correct target acquisition
  - Results in ≈90% reduction in target acquisition/track processor throughput requirements

Technology Trades

- Strapped down target acquisition sensor
  - Advance CMOS focal plane array (FPA)
  - Fast optics
  - Ultra-stiff airframe
  - Low maneuverability target set
- Simplify tracker/guidance system architecture-low cost
  - Modular electronics design (power, ground, serial data bus)
  - Lock-on-before-launch (LOBL)
  - Gunner target acquisition verification
- Ordnance section
  - Contact only fuze
- Rocket motor
  - Moderate performance
- **Result: low cost missile**

Weapon Utility

- Low enough cost to procure in large numbers for use against low cost targets
- Low cost enough to allow for training
- Light weight (5 lb.) enough to get it to the fight
- Can engage time critical fixed and maneuvering targets
- Precision guided weapon - low collateral damage
  - Ideal for urban battle field and littoral defense
- Easily adapts to several requirements/needs
  - UAV/UGV/USV armament
  - Shoulder launched ground force weapon

Summary

- How we are doing it
- Spike missile system
  - Low cost, light weight, low collateral damage
  - Low cost enough for training
- Flexible use
  - TUAV/USV/UGV/Shoulder
- Provides battlefield versatility for the individual warfighter to engage asymmetric threats