



Major Jeff Graham

Marine Representative to NSFS Program Office

Brief for the

**NDIA International Armaments Technology Symposium and
Exhibition**

Jun 2004



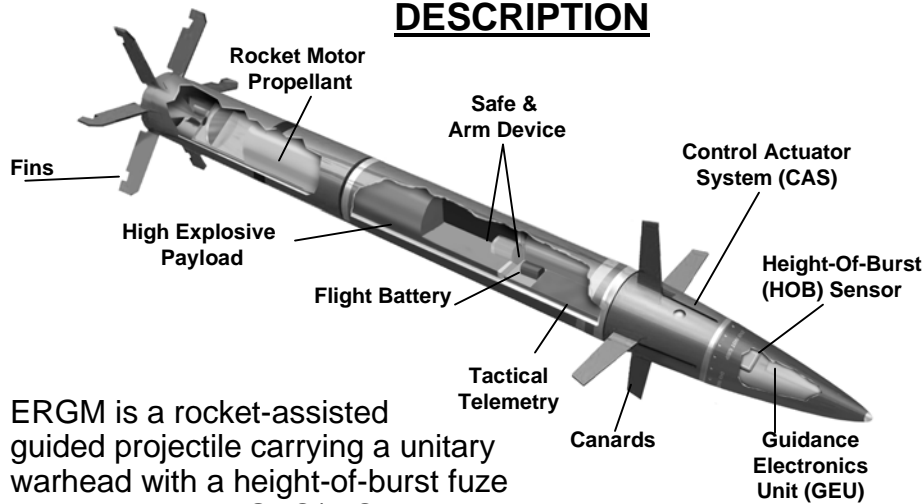
Agenda

- **ERGM**
- **ERM (BTERM)**
- **5"/62 cal gun (Mod 4 Mk 45)**
- **Cruiser Conversion**
- **NFCS**
- **DD(X)/AGS/LRLAP**
- **NSFS Road Ahead**



Extended Range Guided Mmunition (ERGM) Program

DESCRIPTION



ERGM is a rocket-assisted guided projectile carrying a unitary warhead with a height-of-burst fuze and guided by a GPS/INS coupled guidance package. Fired from the 5"/62 MK 45 Mod 4 gun system.

CHARACTERISTICS

- **Length: 61 Inches**
- **Diameter: 5 Inches**
- **Weight: 110 Pounds**
- **Accuracy: <20m CEP**
- **Time-of Flight to Max Range ~5 min**
- **Range: 13Min to ~ 54 Max Nautical Miles**
- **Rate of Fire: 5 – 10 Rounds per Minute**
- **Lethality: Analysis indicates ERGM will meet ORD Requirements Against Stationary Target Set**

SCHEDULE

Fiscal Year	04	05	06	07	08	09	10	11	12	13	14
Milestones							Milestone C		IOC		
Contract Awards	SDD Contract Phase					OT Round Procurement	LRIP Award		Full Rate Production Award		
Test Schedule		Land Based Flight Tests					DT/QT				

IOC not likely until FY08 at earliest

STATUS / ISSUES

- **3 Successful Guided Flights Jan 01 - Jun 02**
- **Successful Critical Design Review (CDR) Completed in May 03 (Land Based Flight Test Release Granted)**
- **Issues:**
 - **Technical problems surfaced during Jun / Oct 03 Flight Tests and Feb 04 Component Tests**
 - **Rocket motor ignition reliability**
 - **Tailfin deployment reliability**
- **Technical solutions identified**
 - **Not yet validated via flight tests**
 - **Program restructuring underway reflecting funding shortfalls leading to schedule delays**



ERGM Acquisition Background

- **Jul 96 - Milestone I/II Decision (IOC originally planned for FY01)**
- **Sep 96 - Contract awarded to Texas Instruments (Now Raytheon)**
 - **Included 500 round LRIP option. Compete FRP**
- **Dec 96 to Apr 98 - Technical challenges caused cost / schedule overruns and APB breach (APB revision and rebaseline initiated)**
- **Oct 98 to May 99 - Raytheon moved Dallas plant to Tucson. Significant impact to technical effort**
- **Jan 02 – N76 Requirements Change. Replace submunition payload with a unitary warhead. IOC shifted to FY06**
- **Latest ASN(RD&A) ADM Direction:**
 - **Aug 02: Waived competitive LRIP and increased quantity to 600. Approved IOC shift and revised continuation criteria dates for Gates 4 and 5**
- **Sep 02 – Contract modification implemented to reflect new IOC and warhead change**
- **CDR completed May 03 leading to start of DT-IIA (Land-Based Flight Tests)**
- **Partial stop-work order issued Feb 04 due to flight failures and funding reductions**



ERGM Technical Status

(Pre-CDR)

CTV-1 - Jan 01

Specifics:

- ◆ 5,500g gun launch
- ◆ 19.5 nautical mile range
- ◆ Time of flight: 124 seconds

Demonstrated:

- ◆ Rocket motor ignition
- ◆ Telemetry operation
- ◆ Flight battery operation
- ◆ 7-Card GEU initialization / operation
- ◆ Canard operation
- ◆ Tail fin deployment

Success

CTV-2 - Dec 01

Specifics:

- ◆ 5,500g gun launch
- ◆ 20.5 nautical mile range
- ◆ Time of flight: 144 seconds

Demonstrated:

- ◆ Rocket motor ignition
- ◆ Telemetry operation
- ◆ 5-Card GEU initialization and IMU sensor function
- ◆ Canard and tail fin deployment
- ◆ GPS acquisition and track to target

Success

Guided Gunfire - Jun 02

Specifics:

- ◆ 10,100g gun launch - at nominal tactical pressure (~65,300 psi)
- ◆ ~38.5 nautical mile range
- ◆ Time of flight: ~220 seconds

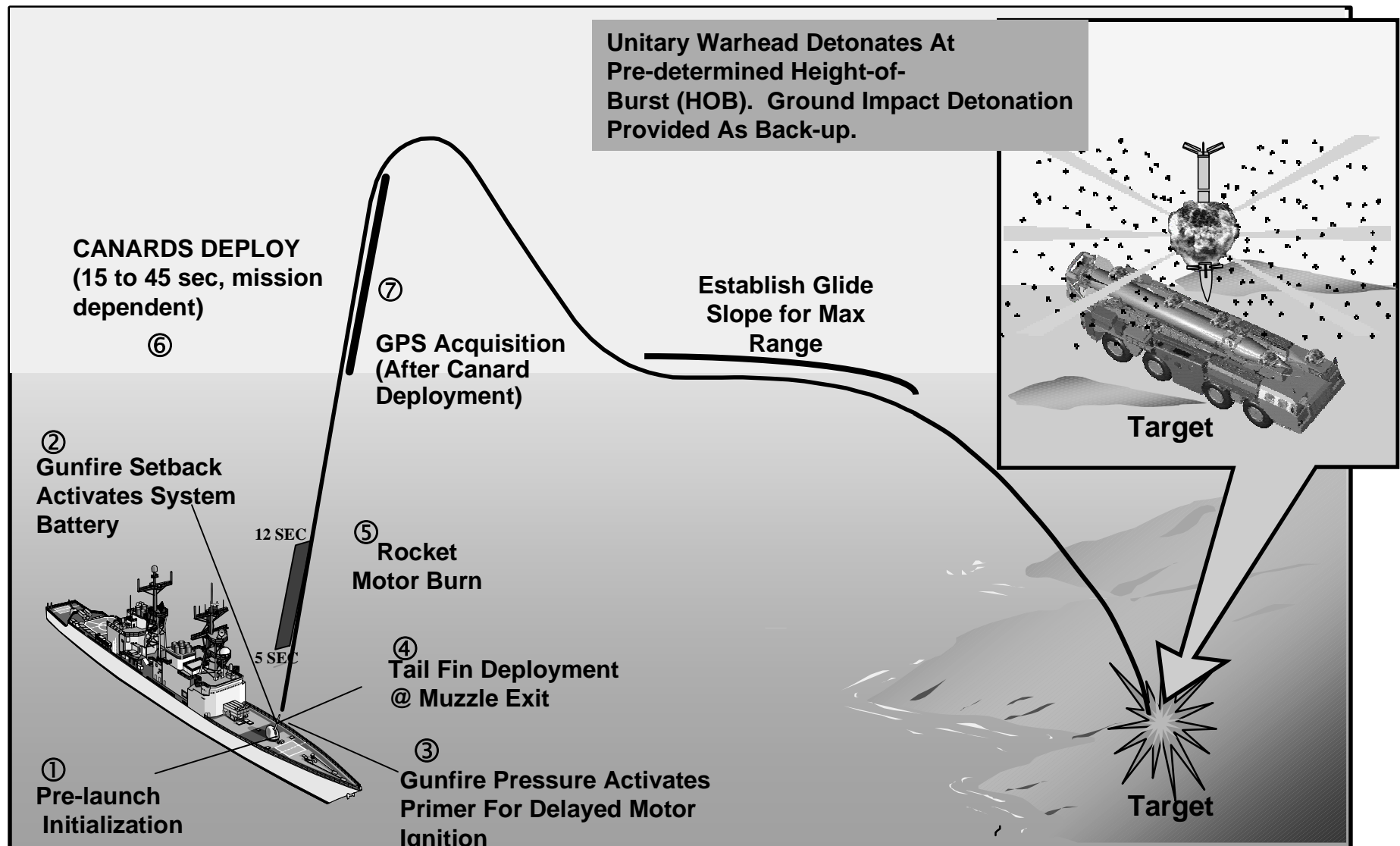
Demonstrated:

- ◆ Rocket motor ignition
- ◆ Telemetry operation
- ◆ 5-Card GEU initialization and IMU sensor function
- ◆ Canard and tail fin deployment
- ◆ GPS acquisition and track to target (10 satellites tracked)
- ◆ Payload initiation signal
- ◆ Guided to within 4 meters of target

Success

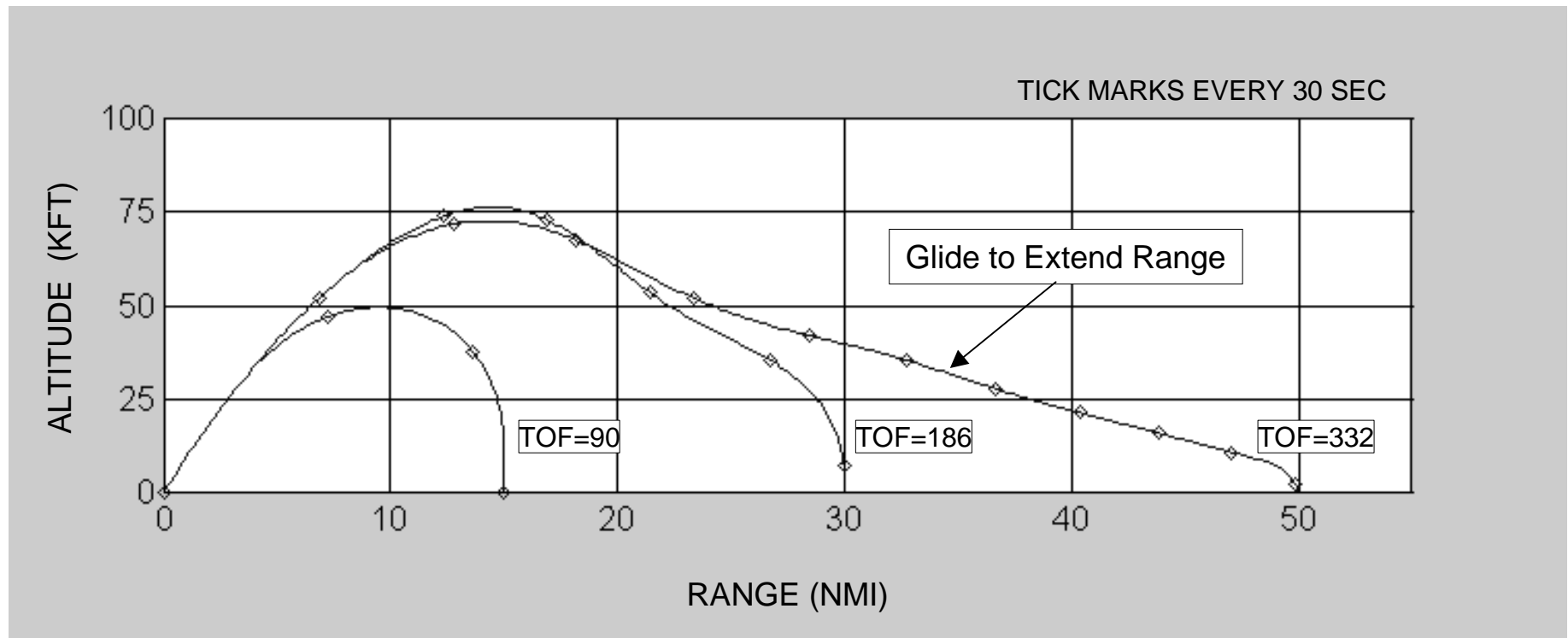


ERGM Flight Sequence





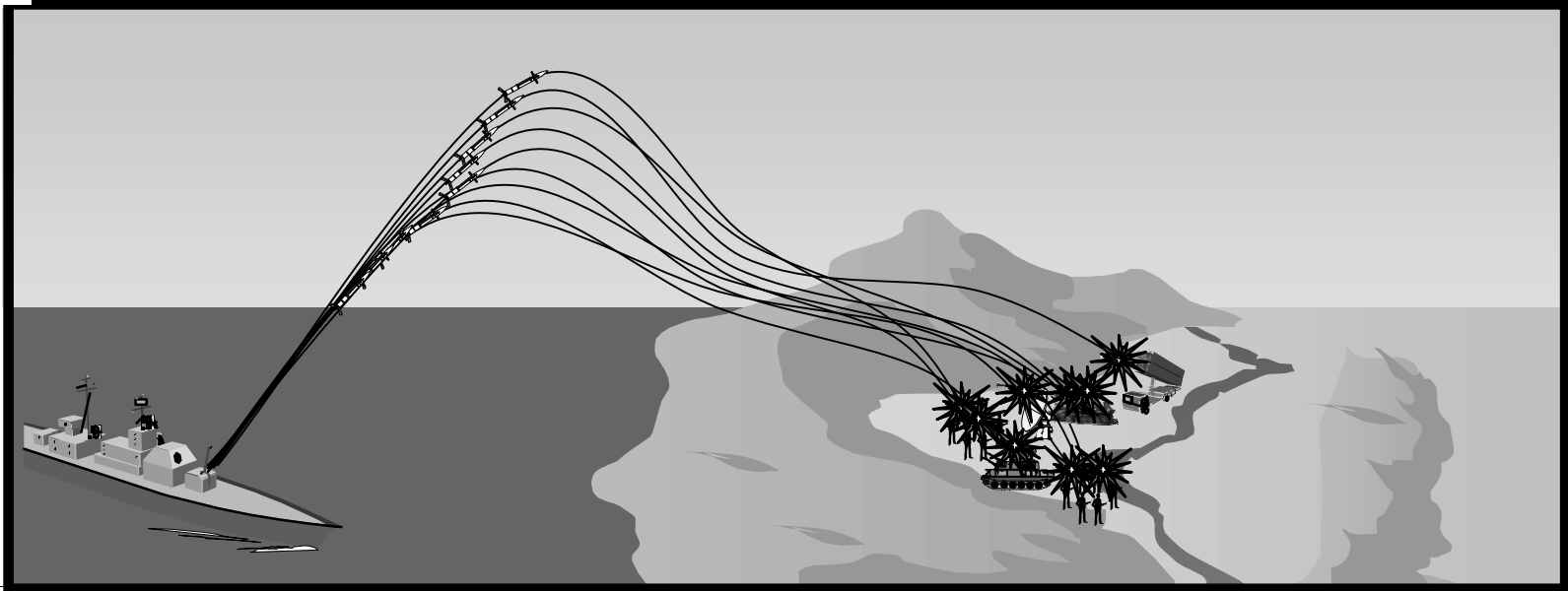
Nominal ERGM Trajectories



- ERGM Utilizes Boost-Glide Approach to Extend Range
- Requires Increased Airframe Maneuverability over Quasi-Ballistic Flight



ERGM MRSI Capabilities

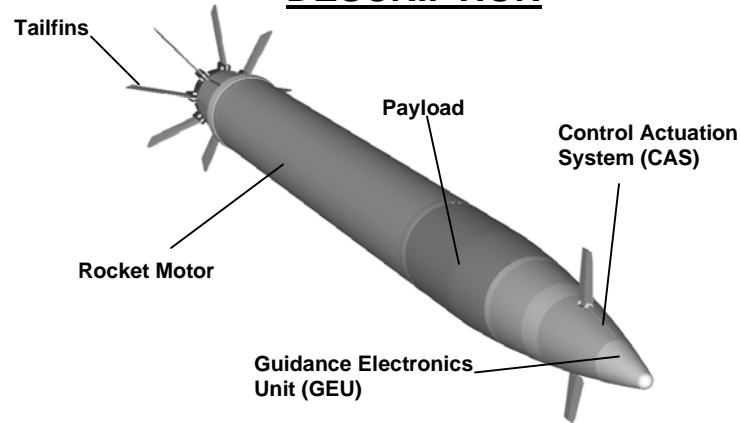


- **ERGM's maneuver capability enables shaping the flight path as a means of controlling time of flight**
- **This means that for a given number of rounds launched within 1 minute from a single gun, the time of flight can be planned such that all rounds impact the target(s) simultaneously**
 - **Thus the acronym Multiple Rounds Simultaneous Impact (MRSI)**
 - **Current maximum capability is 10 rounds per minute, or 10 rounds simultaneously impacting the target(s) @ 30 Nmi**
- **The utility of this capability is:**
 - **Maximum lethality on first volley, before troops have ability to take cover**
 - **Complete suppression of a 450 x 100 m area with one volley**



Extended Range Mmunition (ERM) Demonstration (BTERM aka ANSR)

DESCRIPTION



ERM BAA Demonstration: provide more flexibility than ERGM with lower production unit cost

CHARACTERISTICS

- **Length: 61 Inches**
- **Diameter: 5 Inches**
- **Weight: 96 Pounds**
- **Accuracy: <20m CEP (Projected)**
- **Propulsion: Rocket Assisted**
- **Range: >50 Nautical Miles from MK 45**
- **Rate of Fire: 5 rounds per minute minimum (initialization time dependent)**
- **Lethality: Meet ORD Requirements Against Stationary Target Set (Projected)**

SCHEDULE

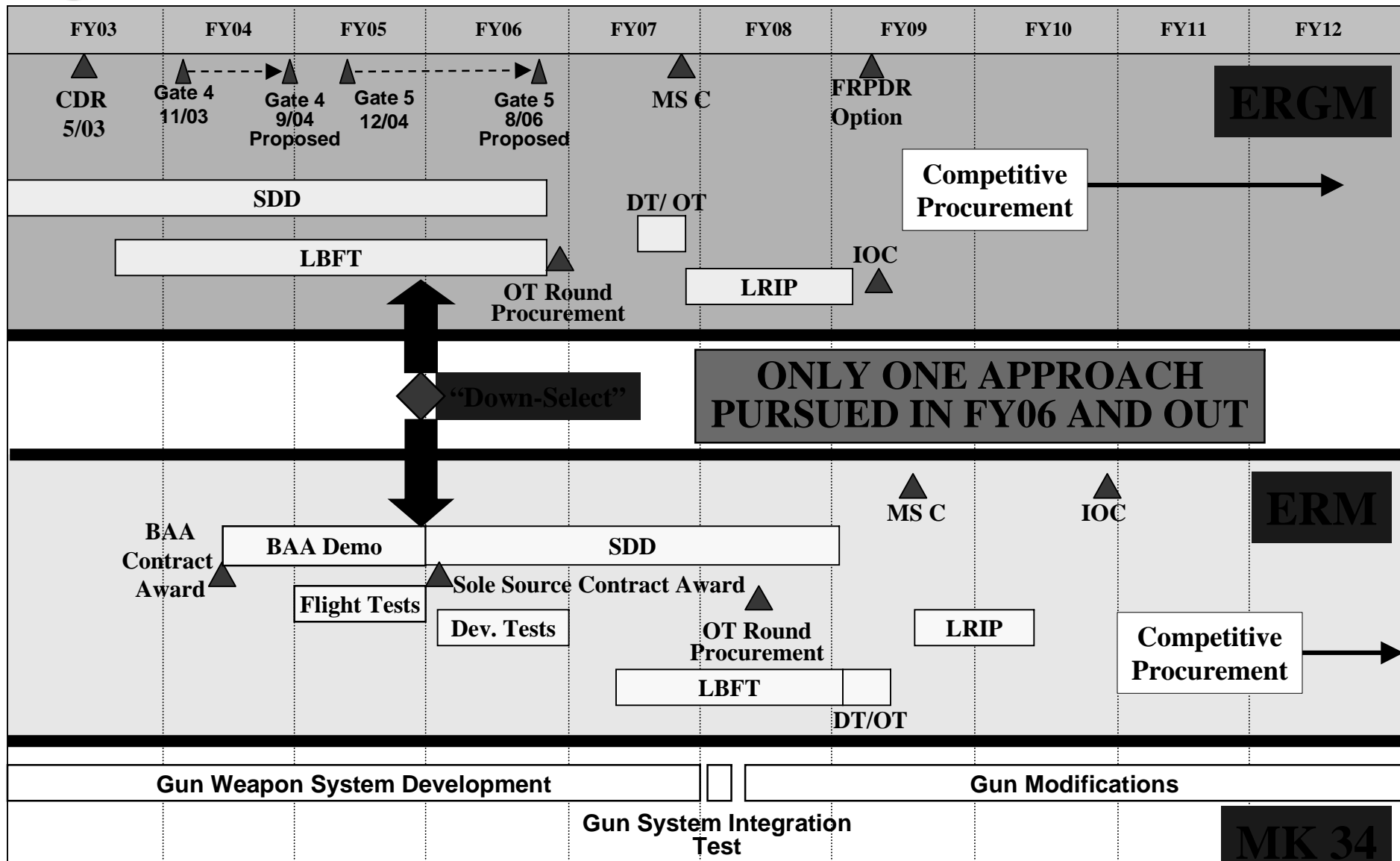
	FY04		FY05				FY06
	3	4	1	2	3	4	1
Contract Award	▲						
Requirements Analysis/Allocation	■						
GEU/CAS Development	■						
Gun Interface Analysis	■						
Payload Development	■						
Rocket Motor/Airframe Development	■						
Component Tests				■			
Flight Tests				■			
Contract Complete							▲
ERM/ERGM Down Select							◆

STATUS / ISSUES

- **Contract awarded to Alliant TechSystems 10 May 04**
- **Issues:**
 - Risk of not meeting the 1st quarter FY06 down select due to the aggressive BTERM II (ERM) Guided Flight Test schedule



5" Guided Projectile Schedule





ERGM/BTERM Down-select

FY04

FY05

FY06

ERGM

LBFTs

BTERM

Demonstration

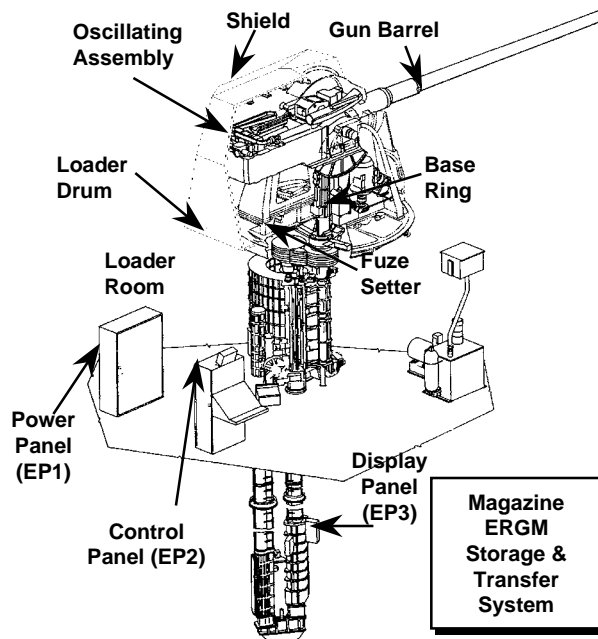
Down-Select

One ERM
Program



5-Inch Mk 45 Mod 4 Gun System

The Mk 45 Mod 4 Combines subsystem upgrades and major firepower enhancements with the baseline system's well established capabilities for all-weather, day/night operation and very high mission availability. This is a proven effective weapon that incorporates the latest in today's multi-mission warships.



CHARACTERISTICS

- **Weight:** 52,920 Pounds
- **Barrel Length:** 5⁷/₆₂ Caliber (25.8 ft)
- **Power Req't:** 440VAC, 60 Hz, 164.35 KW Peak
- **Turning Rate:** 30 Degrees/second train
20 Degrees/second elevation
- **Range:** ~ 13 NM (Conventional) > 41 NM (ERGM)
- **Max Rate of Fire:** > 16 Rnds/Min (Conventional)
> 10 Rnds/Min (ERGM)
- **Automated Ammunition Identification Capability**

SCHEDULE

	FY01				FY02				FY03				FY04				FY05				FY06			
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q
EX 45 5"/62 Mod 4 Gun																								
Milestones																								
Tests																								
Production																								
Tech Demos																								

- 32 platforms will be ERGM/ERM capable
- Installed on DDGs 81-98
- Planned installation through DDG 112
- Do not have mag modes, EHM, etc

STATUS / ISSUES

- **MK 45 Mod 4 gun and MK 160 FCS DT/OT** completed for conventional ammunition
- **FOT&E** planned for ERGM / ERM
- **MS III** to be completed in 4Q FY04
- **Out-year schedule** will be aligned with restructured ERGM / ERM program
- **Issues:**
 - No funding in current budget controls to support installation of ERGM platform mods
 - Technical efforts to complete program include ERGM ORDALT, NAVSSI and setter development, GCS modifications, barrel wear testing



Cruiser Conversion – Nov Fires OAG

- **Upgrades to entire ship**
 - **Combat Weapons System**
 - **MK 51 Gun Weapon System**
 - Mk 45 Mod 4 – 5"/62 Gun (2 per CG)
- **Current proposal calls for 12 CGs to be “converted” during FY06-FY11 timeframe**
 - 1-1-2-2-3-3
- **Includes ERGM Magazines (total 236 ERGM)**



Cruiser Modernization

- **Nov 03: Original Plan for 22 cruisers to receive upgraded MK45 Mod 4, 5"/62 cal guns (total 44 guns)**
- **Jan 04: Decision to save money by not upgrading guns (\$100M cut from Cruiser Modernization)**
- **Jan/Feb 04: OPNAV attempts to salvage Cruiser 5"/62 gun upgrade program**
- **23 Feb 04: SWCC decides no requirement; cruisers will not be upgraded with 5"/62 guns**
- **4 May 04: Congressional letter asking USN to reconsider decision**
- **Discussions ongoing regarding future of CG modernization MK 45 gun upgrade**



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ERM Platform Availability

Guided Projectile capable platforms (DDG 81-112) will come on line as follows:

	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11
Mod 4 Guns in Fleet* (Cumulative)	10 (DDG 81-90)	13 (DDG 81-93)	18 (DDG 81-98)	21 (DDG 81-101)	TBD	TBD	TBD	TBD
Mod 4 Guns in Fleet (ERGM Capable, Cumulative)	0	0	0	0	1 (DDG TBD)	3 (DDG TBD)	6 (DDG TBD)	9 (DDG TBD)

*Defined as Completing PSA

- 89 surface combatants with 5" guns*
- 32 currently proposed to be ERM capable*



MK 45 Mod 2 ERM Upgrade Configuration Features

- Retained Mod 1/2 Gun Features
 - Barrel, Oscillating Assembly, Trunnion Supports, Base Ring, Ventilation System
- Required Upgrades
 - Similar EP1/EP2 Panels Similar Pointing Power Drives (Digital Regulators, EP4/EP5)
 - MK 63 Mod 2 Weather Shield
 - Loader (Ammo ID Sensors)
 - Mechanical Fuze Setter (Resolvers)
 - ERGM/ERM Initialization Setter
 - Ammo Hoist (Digital EP3, Ammo ID Sensors)
 - Ammo Handling Mechanism



MK 45 Mod X ERM Upgrade Cost Summary

Non-Recurring Cost

– NRE Contractor (24 Months Development)	\$ 6.9M
– NRE & Prog. Mgmt. IWS3C	9.3M
– Land-Based Integration & Training Development (Includes two (2) MK 45 Mod X Guns)	18.2M
<i>Total</i>	\$34.4M

Procurement Cost

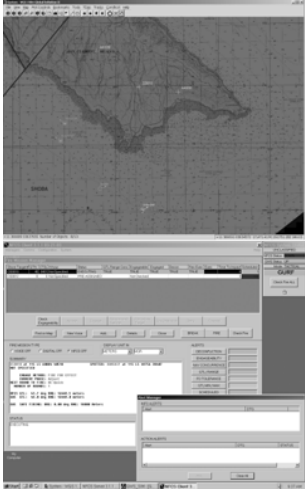
– MK 45 Mod X Gun (18 Months PLT)	\$9.1M per Gun
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Note: First Mod X Gun available for shipboard installation 36 months after program initiation



NAVAL FIRES CONTROL SYSTEM (NFCS; AN/SYQ-27)

PROGRAM DESCRIPTION



Automated Mission Planning system on Surface Combatants to employ Naval Surface Fire Support (NSFS) Weapons in support of Joint Forces.

Installations complete on DDG 81-90 and planned on DDG 91-112 and CG 52-73.

CHARACTERISTICS

- Dual Screen display with multiple clients utilizing the 4 ATDCs in CIC.
- Supports both Voice and Digital CFF from FO.
- Interoperability with AFATDS, GCCS-M, and GWS.
- Supports Digital Communications ashore using VHF, HF, and UHF SatCom and afloat using ADNS.

CURRENT FORCE

- NFCS will IOC in FY04.
- Enables faster, safer, and more efficient volume of fire.
- Displays the Land Attack (SA) picture of OPAREA and provides automated deconfliction for NGF.
- Supports all current 5" munitions and NGF Missions.
- Training in place at FCTCLANT school house.

STATUS

- Completed Technical and Operational Evaluations in April



NFCS Program Status

- **NFCS rack complete installed onboard DDG 81 thru 9**
 - System are not operational until IOC
- **TECHEVAL: 28 Feb - 26 Mar 04**
 - Test ship – DDG 82 (primary) & DDG 88 support NFCS to NFCS comm
 - Successfully completed 26 Mar 04
 - Quick-Look report released 8 Apr 04
 - Final report end of May 04
- **OPEVAL: 26-30 April 04**
 - Test ship – DDG 82
 - Completed 29 Apr 04
 - COTF report due mid Aug 04
- **M demo: 3-5 May 04**
 - Completed 5 May 04
- **Full Rate Production/IOC: Sept 04**



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Current Flight I DD(X) Design

IOC: FY13

Sensors

Dual Band Radar
ES / ELINT
Acoustic Sensor Suite
EO / IR System

Weapons

(80) AVLS Cells
(2) AGS 155mm Guns with (600) rounds
(2) 40mm Close in Guns
(2) Torpedo Defense (space & weight)

Characteristics

Length	600 ft	Displacement	14,064 LT
Beam	79.1 ft	Instld Power	78 MW
Draft	27.6 ft	Crew Size	150
Speed	30 kts		

Integrated Power System

(2) MT 30
(2) Small gas turbine gensets
(2) 36 MW Permanent Magnet Motors

Aviation

(1) MH60R &
(3) VTUAVs

Hull

Wave-piercing tumblehome

Superstructure

Composite structure

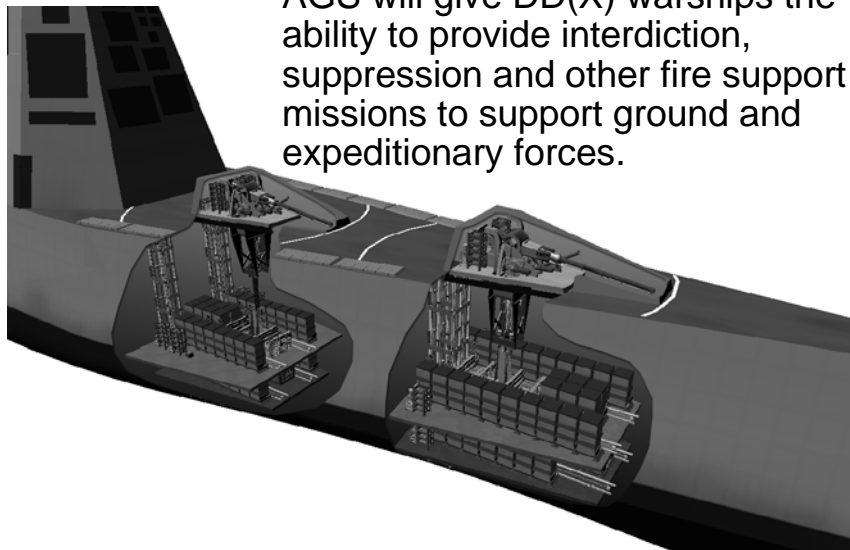
Boats

(2) 7m RHIBs



Advanced Gun System (AGS) for DD(X)

AGS will give DD(X) warships the ability to provide interdiction, suppression and other fire support missions to support ground and expeditionary forces.

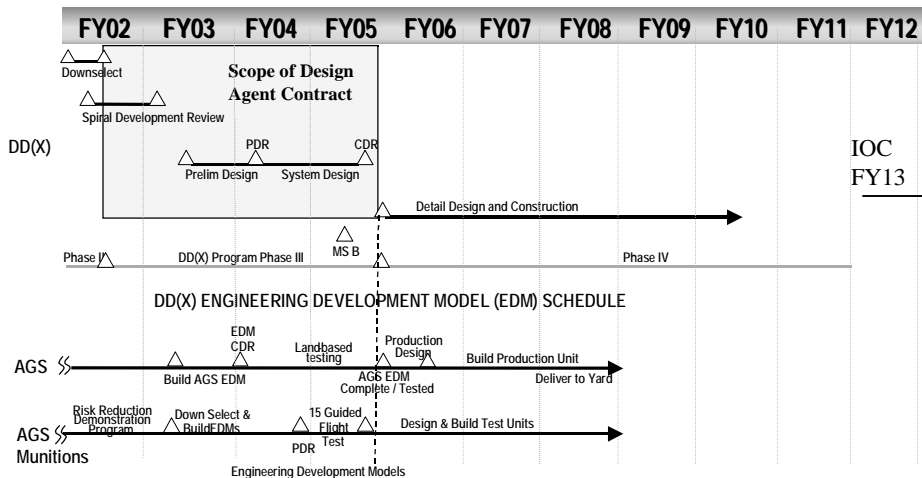


CHARACTERISTICS

155mm Fully Automated Gun System

- **ROF: 10 rounds per minute sustained/gun**
- **Range: 100 nmiles (objective)**
- **Guidance: GPS/INS**
- **Warhead: 24lb Blast Fragmentation**
- **Reaction Time: < 20 seconds**
- **Magazine Capacity: 600+/ship**
- **Sustainment: At sea replenishable pallets**

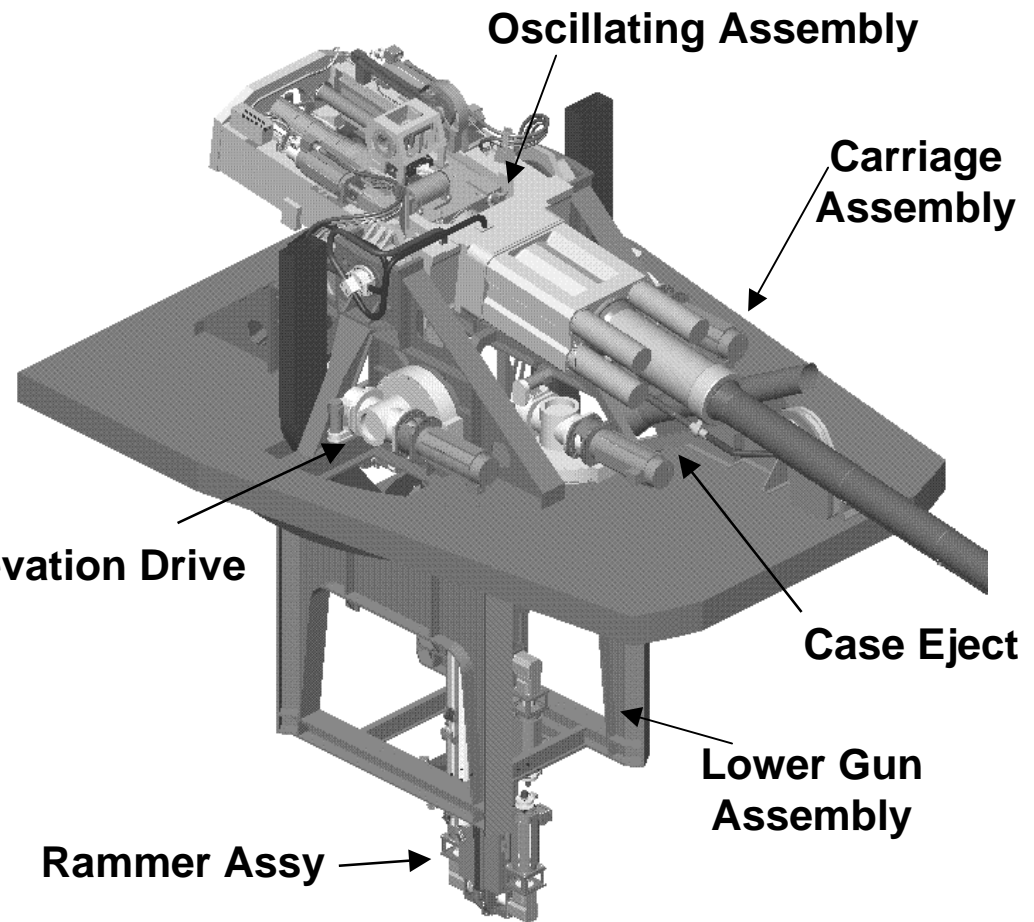
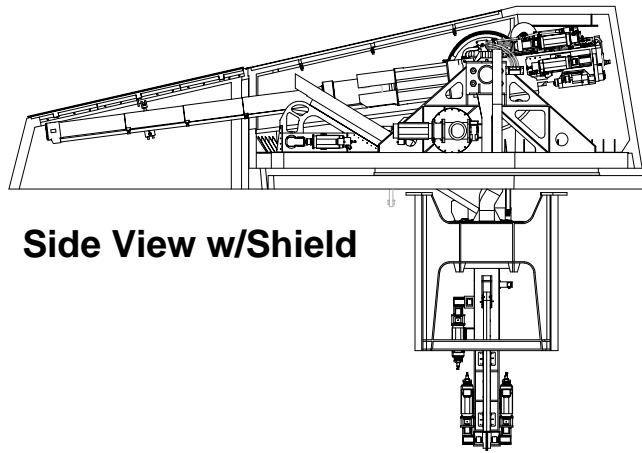
SCHEDULE



STATUS / ISSUES

- **Magazine Rate of Fire Performance**
- **Interior Ballistic Performance**
- **Rate of Fire**
- **Barrel Wear**

AGS Gun Mount Arrangement

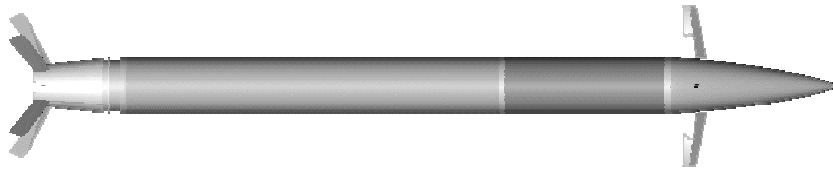


- 155 mm 62 caliber
- 10 RPM continuous firing rate at 60 degrees elevation
- Liquid-cooled barrel and recoil cylinders
- Loads at 90 degrees elevation
- Single-ram loading
- Fixed angle case ejection



Long Range Land Attack Projectile (LRLAP)

DESCRIPTION

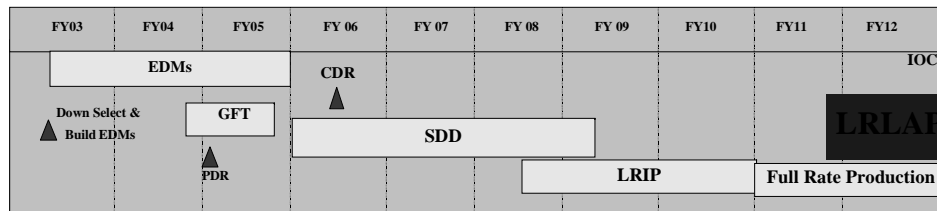


Give DD(X) warships the ability to provide interdiction, suppression and other fire support missions to support ground and expeditionary forces.

CHARACTERISTICS

- **Length:** 14.5 calibers (88 inches)
- **Diameter:** 155 mm
- **Weight:** 260 lb max.
- **Guidance:** GPS/INS
- **Payload:** Unitary Warhead (23.8 lbs of HE)
- **Range:** 100 nmi (Objective)
- **Storage:** In pallet throughout life cycle

SCHEDULE



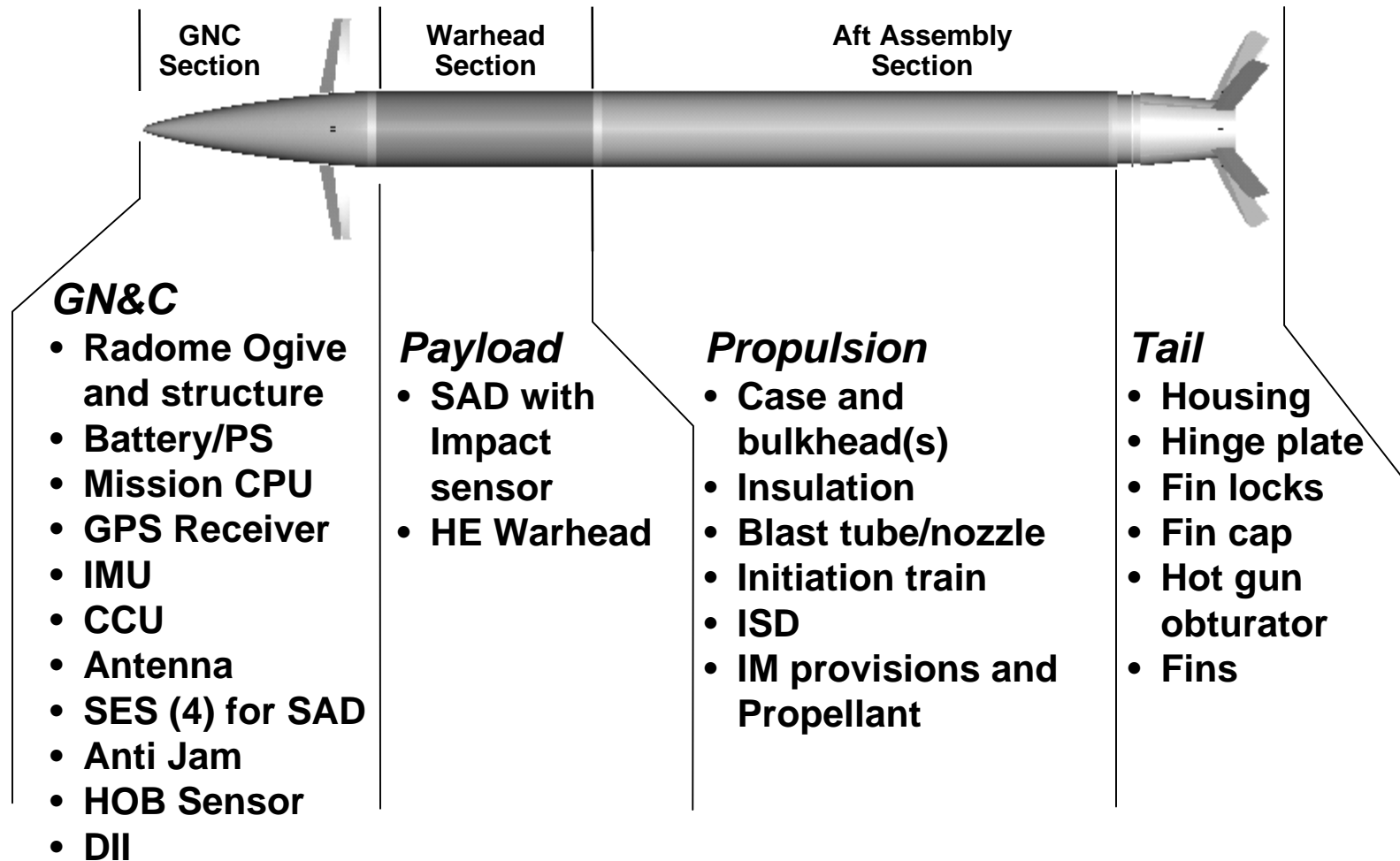
-LBFTs begin late FY04 and continue through FY05

STATUS / ISSUES

- **Phase II was completed in Feb 03**
- **Phase III EMD contract awarded to Lockheed Martin in Apr 03**
- **Issues**
 - Range / Accuracy
 - Initialization
 - Insensitive Munitions
 - Warhead Performance
 - Muzzle Exit Time

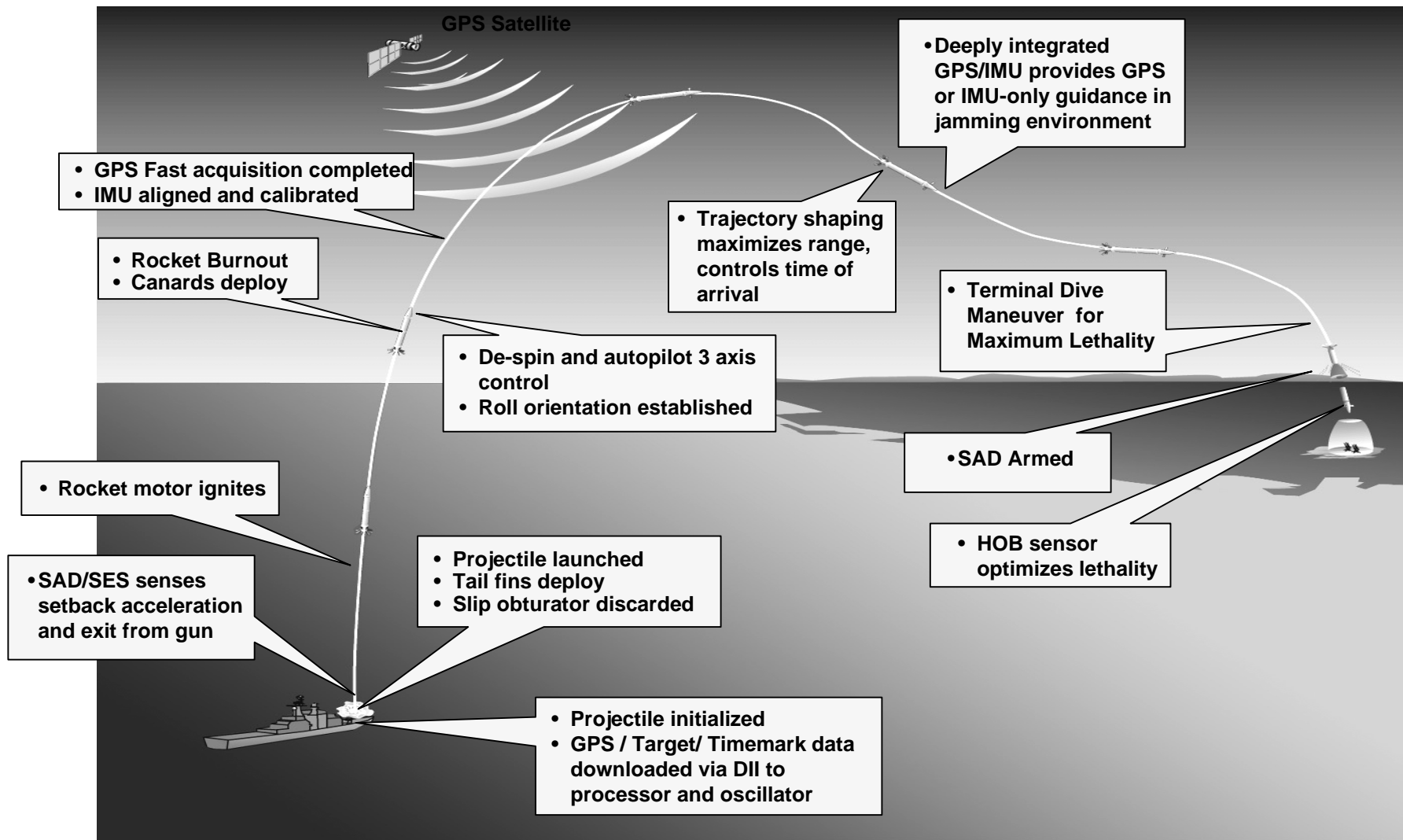


Tactical Design Overview





AGS LRLAP Operation



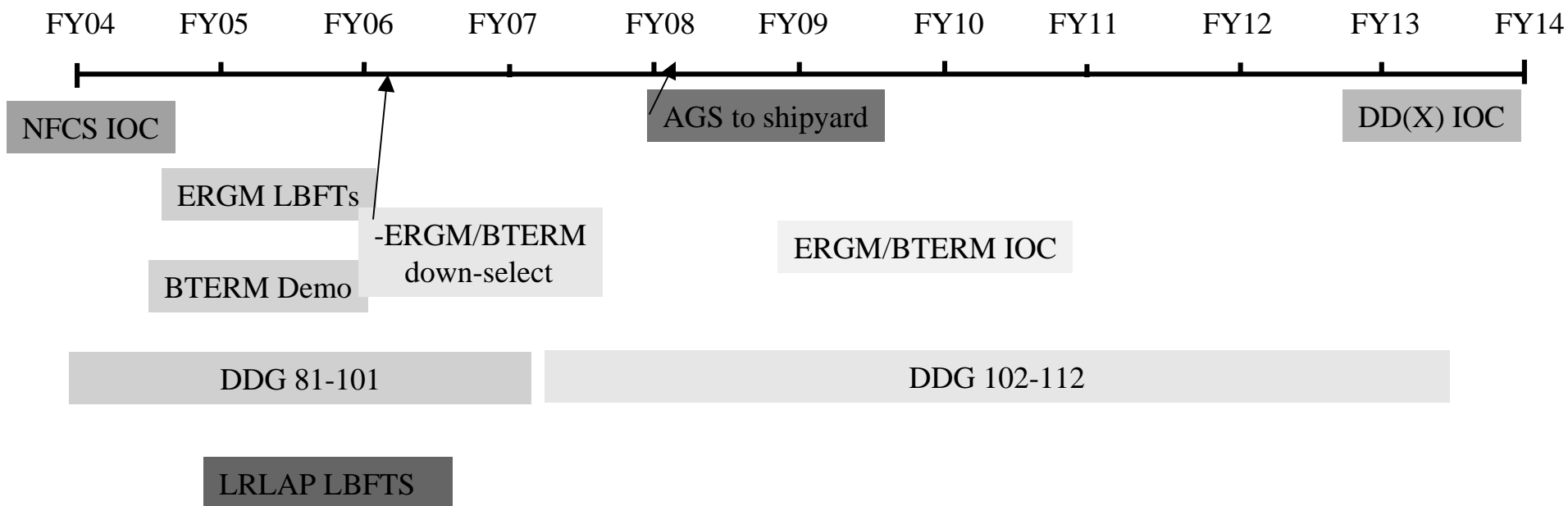


Conventional 5” Munitions

- **13nm max range from both 5”/54 and 5”/62**
- **21nm max range possible from 5”/62 with higher energy propellant**
 - *Propellant development not currently funded*
- **With current procurement and expenditure rates, USN stockpile of most conventional ammunition will expire by FY09**
 - *Will most likely decrease expenditure rates...training ammo*



NSFS Road Ahead



Issues:

- ERGM/ERM \$ in USN crosshairs*
- EM Rail Gun looking for \$*



Questions?