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Advanced Crew Served Weapon (ACSW)– XM307; Ammunition Crew Safety & Precision Air-Burst

Presented by:

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April 2005, Seattle, Washington

Program Team

PROJECT MANAGER SOLDIER WEAPONS

TEAM SOLDIER

PRODUCT MANAGER CREW SERVED WEAPONS

ARMAMENT RESEARCH, DEVELOPMENT & ENGINEERING CENTER PICATINNY, NJ

FUTURE COMBAT SYSTEMS

FCS

One Team-The Army/Defense/Industry

GENERAL DYNAMICS
Armament and Technical Products

KAMAN AEROSPACE

GENERAL DYNAMICS
Ordnance and Tactical Systems

Raytheon

EDO corporation
GLOBAL TECHNOLOGY REACH

ACSW System

- Lightweight, crew portable weapon system
- 25mm Airburst ammunition
- 250 SPM
- Full ballistic solution
- Programmable ammunition with muzzle velocity correction
- TA/FCS laser range finder & target tracking

GENERAL DYNAMICS
Ordnance and Tactical Systems

Raytheon
KAMAN FUZING

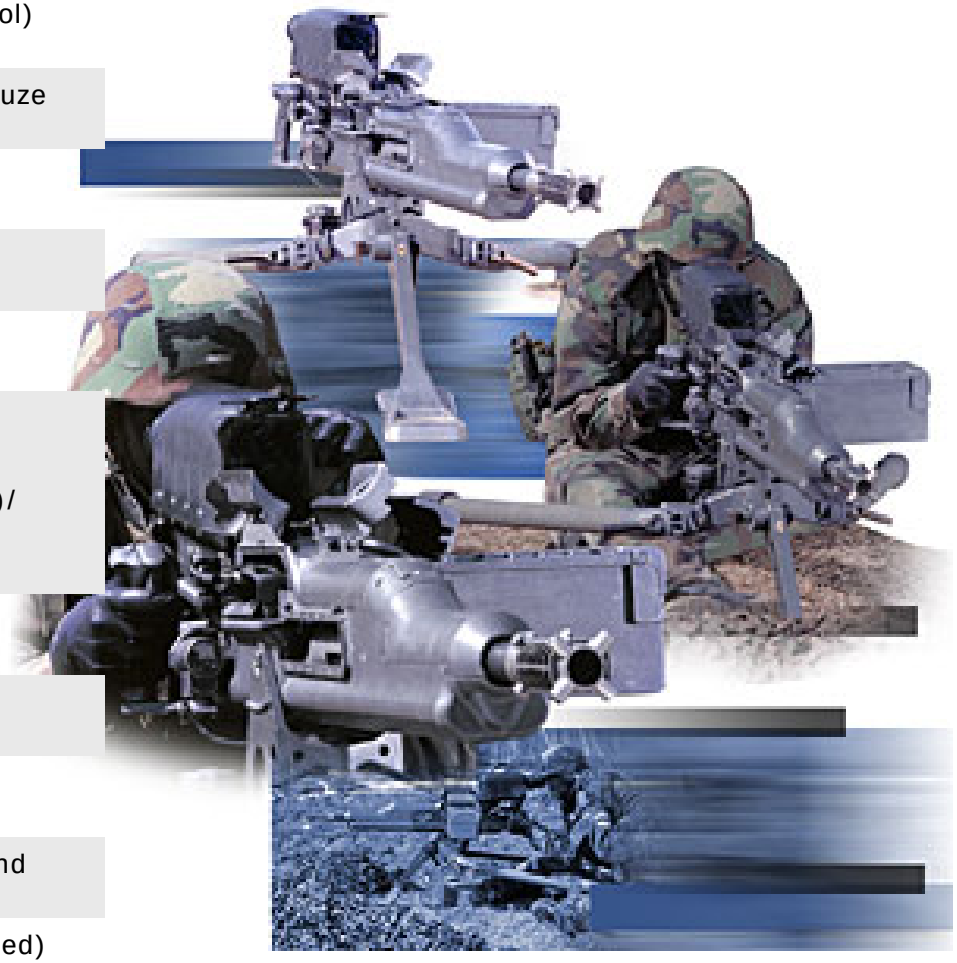
GENERAL DYNAMICS
Armament and Technical Products

Current XM307 Program Status

- SDD contract awarded in ’04
- XM307 met all ATD exit criteria
- Maturity TRL 6
- Demonstrated:
  - Full system integration
  - Fire control
  - Ammunition through system integration tests
- Progressing weapon maturity, durability and reliability
- XM307 is the weapon of choice for unit of action application and other weapon platforms

Weapon Spec's

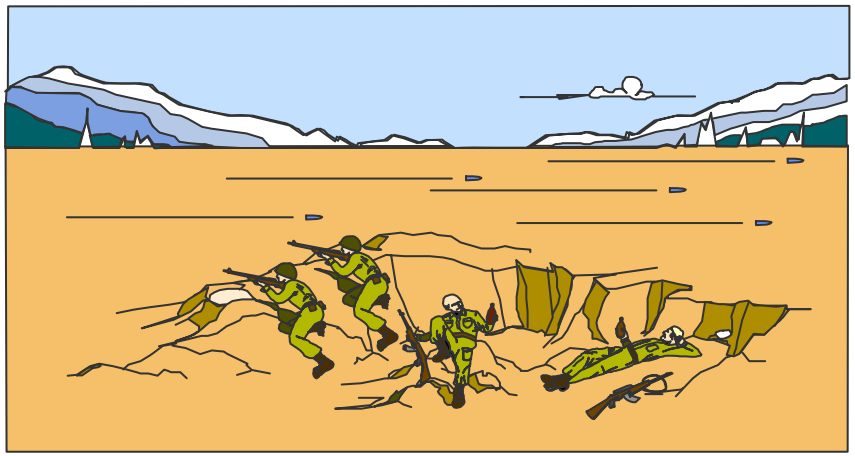
System
Weight 50 Pounds (19.05 kg) (Gun, Mount, and Fire Control)
Fire Control Full Solution, Day/Night, contact interface to fuze
Portability Two-Man Portable & Vehicle Mountable
Stability Up to 18-Inch Tripod Height
Environmental Operationally Insensitive to Conditions
Gun
Dimensions 9.9Wx7.2Hx52.3L max inches (43.3L charged)/ 251.46x182.88x1328.42mm (1099.82 charged)
Rate of Fire 250 Shots per Minute, Automatic
Dispersion Less than 1.5 Mils, One Sigma Radius
Range Lethal and Suppressive Out to 2,000 Meters
Ammunition High-Explosive Airbursting, Armor Piercing, and Training Ammunition (HE, AP, TP, TP-S)
Feed System Weapon-Mountable Ammunition Can (Left Feed)



Air Bursting Munitions

(A New Dimension to Infantry War fighting Capability)

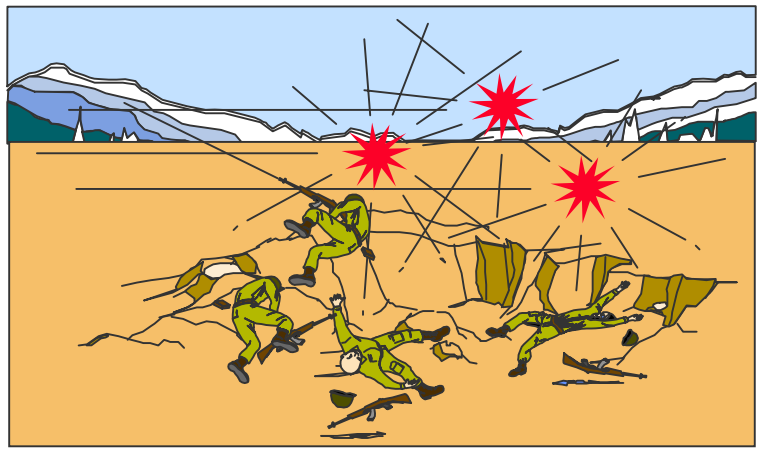
KE Ammunition Can Only Suppress Personnel In Defilade



Target Postures

- Percent of the time
  * 5% Standing
  * 20% Gone to ground
  * 75% Gone to defilade

Air Burst Ammunition Kills



System Operation

* Laser range on target or near terrain
* Adjust aim point on target
* Fire
* Projectile air burst on target

ACSW Fuze System

ACSW Fuze

S&A Mechanical

- Runaway escapement
  - Setback
  - Spin
- Lead rotate in-line at arm point

Electronic Module (EM)

- Interface with FCS
- Digitally controlled clock
- Electrical energy storage
- MVC
- Count down logic
- Detonator fire circuit
- Fixed detonator

IPS-S

- Independent power
- Active after setback
- Sterilize round (if flight interrupted before Arm)
- Point detonate

Hybrid Fuze architecture provides precision airburst & safety

ACSW Ammo

Family of ammunition includes:

- Armor Penetrating
- Air Burst
- Target Practice
- Target Practice - Spotting

Wide range of ammo for a wide range of needs

Safe & Arm device for SDD

- Type: Runaway verge escapement
- Miniature Size - .300 thick
- Operational capabilities
  - 40,000 RPM, 110,000 G setback
  - No change in arm distance with temperature
  - No lubrication required
  - minimal scatter
- Meets intent of MIL-STD-1316- setback & spin
- Design will meet MIL-STD-331 safety tests
- Low cost
  - Simple construction – 11 components, Plastic components, no beryllium-copper,
  - Spin lock – one piece centrifugal spring
- Suitable for 20mm – 40 mm applications

Crew safety emphasized through simple, rugged design

Electronic Module (EM) Design

- Contains communication, MVC detection/correction, and sterilization circuitry.
  - Contact bands on housing allow low power, 2 way communication between fuze and Fire Control System (FCS)
    - Allows programming confirmation (talk forward and echo back) for improved system reliability.
    - Time available for powering the fuze & up to 4 programming attempts, & still support 250 rounds per minute rate
    - Fuze can be programmed as many times as FCS commands & confirms (for laze on different targets)

Approach provides lightweight, power transfer efficient, fast & effective weapon system to US ground forces

Electronic Module (EM) Design

- Independent Power Supply-Sterilization (IPS-S) module, within EM, senses when projectile has come to rest, or impacted target.
  - Fires detonator to consume warheads if S&A has armed.
    - Provides point detonating function if contact with solid object occurs, past arming point.
  - Fires detonator out of line to render spent ammo sterilized if S&A has not armed.
  - Contains independent power supply to assure function even if no power from fuze setter.

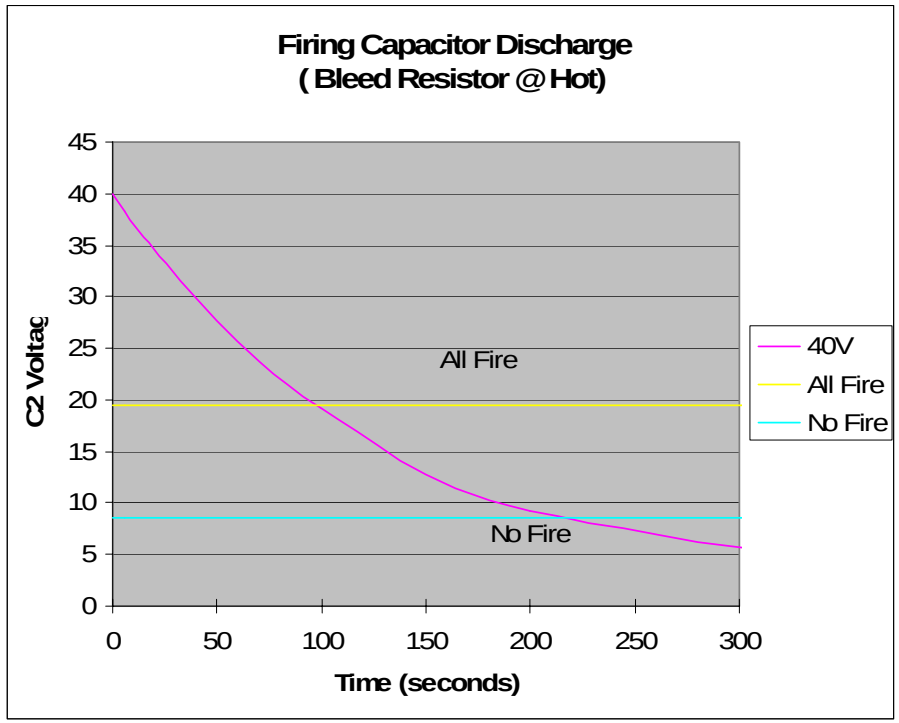
Allows use of ammunition without electrical power on weapon system, and provides method of sterilization & method of point detonate. This improves both ammo lethality & crew safety

Electronic Module (EM) Design

IPS-S Design (continued)

EOD Resistor

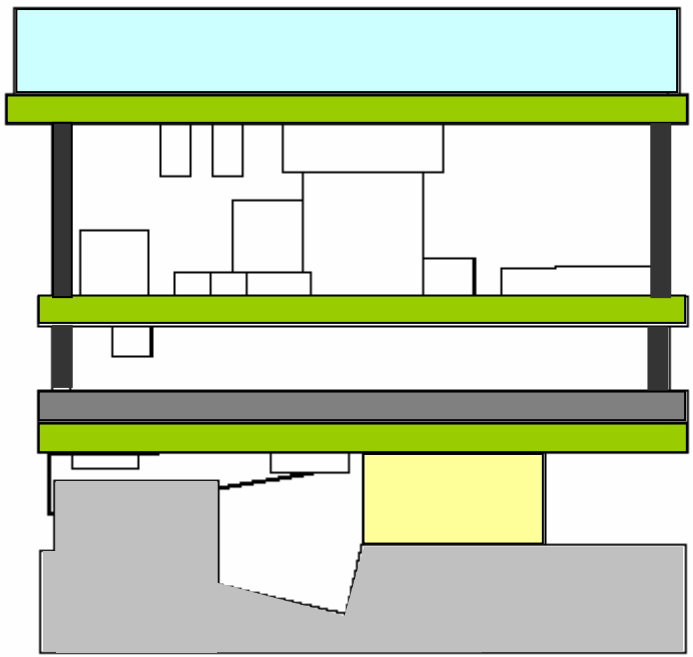
- Bleed Resistor on fire Capacitor, using data collected at worst case
  - Approximately 90 sec > all fire detonator voltage (31 sec min from SDD Spec)
  - Approximately 210 sec < no fire detonator voltage (20 min EOD Requirement)



Provides IPS-S all-fire energy for detonator function out to maximum range, and will also meet EOD requirement of 20 minutes bleed off

Electronic Module (EM) Design SDD enhancements

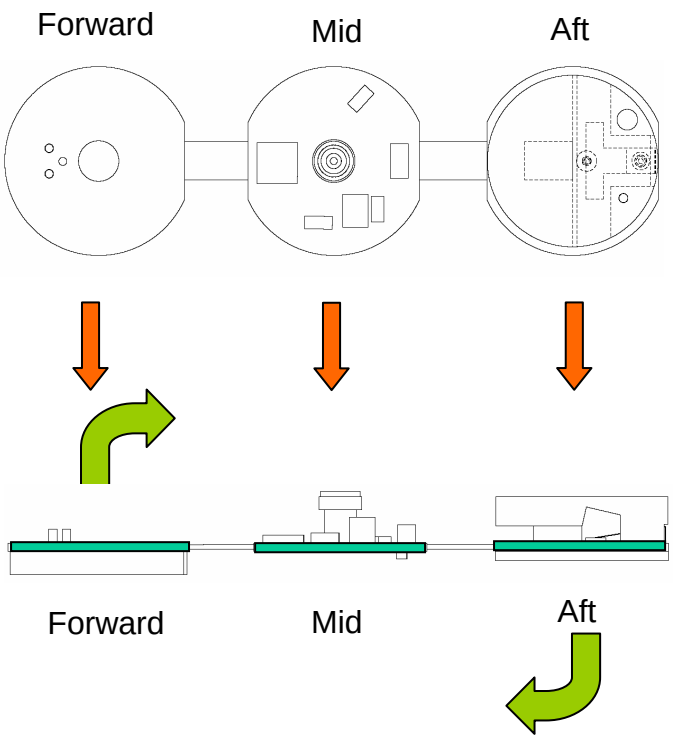
EM is key to air-Burst capability counting down time from setback to intended Burst point.



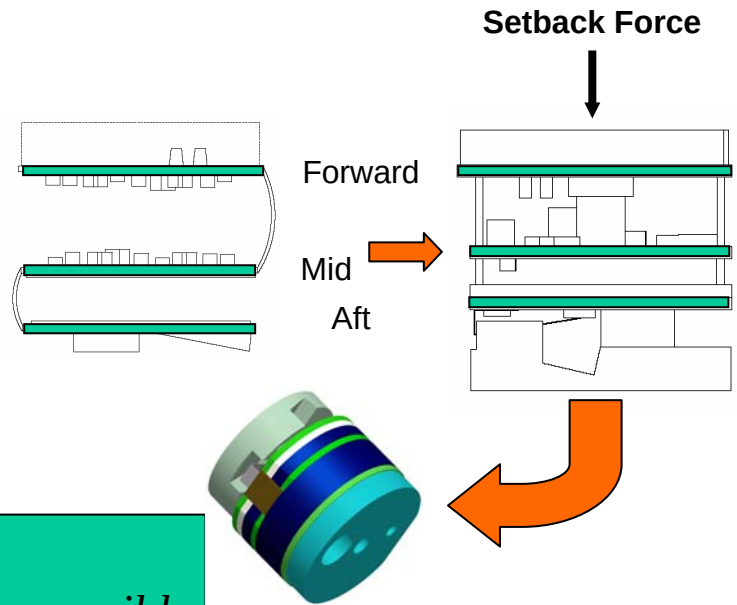
- Three section integrated flex replaces 2 board rigid flex with separate IPS-S approach from ATD
  - No additional interconnects
  - All electronic components on one side enhances manufacturability
- Advanced micro-controller for refined MVC accuracy
- Rivet / leaf spring connection to contact bands
- 3 pin start switch (vs. 2 pin on ATD) for improved reliability
- Stand-alone *complete* assembly
  - Potted as one piece
  - New potting material

Successful ATD topology enhanced for manufacturing & refined burst point accuracy

SDD Three flex circuit EM design



- Resolves interconnect issues with setback pins, coil, contact bands, Detonator, IPS-S
- Automated manufacturing friendly



One, single-sided populated circuit board for all circuits keeps manufacturing cost as low as possible

Electronic Module (EM) Design

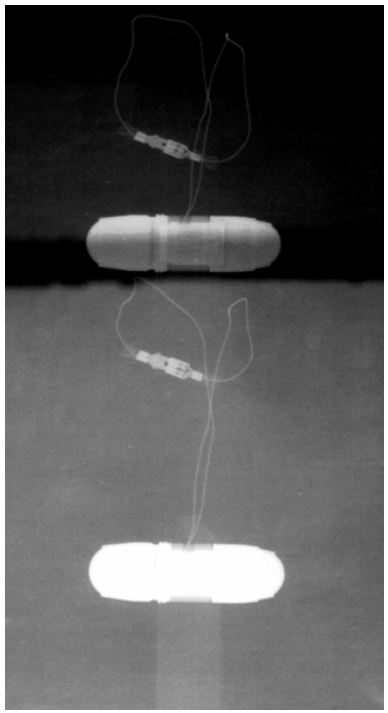
- MVC circuit senses exit velocity and calculates time of flight correction for enhanced accuracy
  - Accurate for super-sonic & sub-sonic flight

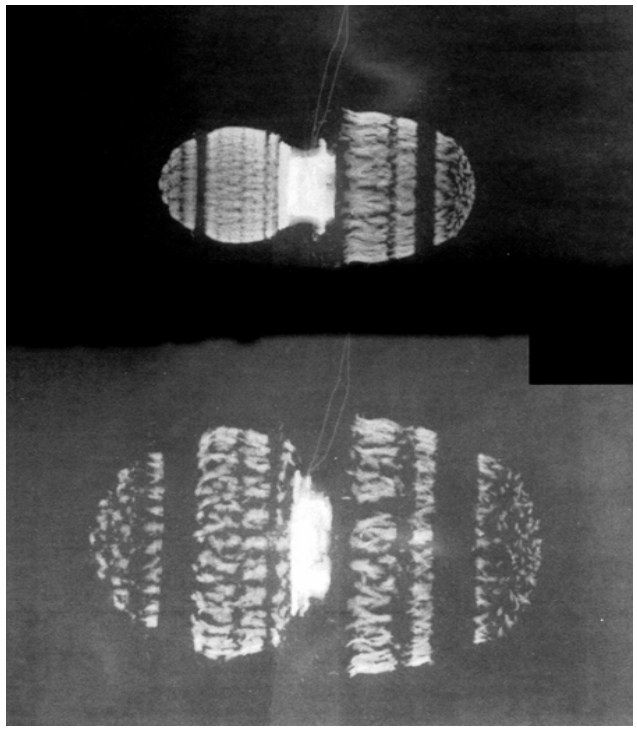
Description	SDD Exit criteria Requirement
B.P Average	+/-3 meters @600 meters for 5 shots
B.P. St. Dev.	Less than 1.5 meters @600 meters for 5 shots

Lethality enhanced by burst point accuracy

SDD Explosive train

Dual Warhead Approach





Dual warhead approach maximizes fragments fore & aft for maximum lethality

Summary:

Precision Airburst:

- Airburst Ammo provides lethality and suppression of personnel in defilade
- Accurate count-down timer adjusts for Muzzle Velocity at exit providing precision airburst on target
- Mid-body fuze provides forward & rear warhead sections for maximum fragment dispersion
- Rapid communication & efficient power transfer provide high shots per minute rate on target
- SDD reliability requirement is 98%.
  - ATD demonstrated 484 airbursts out of 513 shots, for 94% reliability

Safety:

- Setback & Spin locks within fuze provide 2 independent arming environments for Mil-Std-1316 compliance.
- Mil-Std-331 tests; Jolt, Jumble, Progressive Arming demonstrated
- Consistent arming obtain through use of nearly frictionless S&A design
- Two U.S. Army fuze board presentations to date
- IPS-S module sterilizes ammo thru point detonate function, or spin down