Advancements in Lightweight .50 Caliber Ammunition

Presented By:

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.50 Caliber Polymer Case

- **Background**
  - Initially a Small Business Innovative Research program out of Marine Corps Systems Command 2004-2007 for lightweight ammunition.
  - Transitioned to a Title III program to develop a domestic production capability for lightweight polymer based ammunition.
  - Title III contract awarded to MAC, LLC , located in Bay St. Louis, MS on 18 September 2008
    - Focus was on the development, production, and qualification of lightweight .50 caliber ammunition

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- **MK 323 MOD 0**
- **Cartridge Design**
  - Hybrid cartridge case
    - Brass base cap
    - Polymer caselet
  - M33 projectile
  - WC 869 Propellant
  - No. 35 Primer
- **Packed 100 linked cartridges per M2A1 ammunition can**

MK 323 MOD 0

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- **Cartridge Performance**
  - Meet or exceed the ballistic requirements of M33 per specification MIL-DTL-10190F
    - Chamber Pressure
    - Muzzle Velocity
    - Action Time
    - Accuracy
  - Function in all fielded weapon systems (i.e. M2HB, GAU 21/A, etc.)

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- **Benefit**
  - 25 % weight savings over conventional brass cased ammunition
  - Given the large number of platforms and missions, operational benefits of lightweight ammunition vary
  - Biggest payoffs in weight-critical scenarios:
    - Increase effectiveness, due to larger quantity of rounds carried
      - Fewer reloads
    - Operational flexibility – carry more equipment
    - Increased operational range
    - Reduced fuel consumption
    - Less fatigue to personnel

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- **Cartridge Development and Challenges**
  - Initial development work conducted exclusively with the M2HB
  - As a drop-in replacement for M33, the MK 323 had to be functional in all .50 caliber platforms
  - XM218 and GAU 21/A were introduced
    - Initial testing revealed the cartridge could not endure the higher rate of fire aircraft weapons
      - Projectile setback in cartridge case
      - Case separation at the joint between the brass cap and polymer caselet.
        - » Case separation caused by combustion gases entering the interface between the polymer cartridge caselet and the brass base.
    - Issue was corrected by a change to the internal geometry of the case to completely seal the interface.

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- **Program Status**
  - Cartridge design has been frozen
  - Test and Evaluation Master Plan (TEMP) in process
    - TEMP includes performance testing and required safety qualification testing for future fielding.
    - 90% complete with the initial performance testing against the baseline M33 ball round.
    - Safety qualification testing anticipated start of July 2012

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- **Initial Performance Testing**
  - MK 323 Lot: BYS12B264S-001
  - M33 Lot: LC-10D406-994
  - Chamber Pressure, Muzzle Velocity, and Action Time
    - Conducted in accordance with SCATP-7.62mm

Ammunition Type	Temperature	Pressure	Velocity		Action Time
		Mean (psi)	Mean (fps)	Std Dev	Mean (ms)
M33	+ 70F	53,359	2,881	15	1.471
	- 25F	47,150	2,720	24	1.581
	+ 145F	57,220	2,996	16	1.431
MK 323	+ 70F	50,648	2,852	11	1.467
	- 25F	53,324	2,849	20	1.506
	+ 145F	43,867	2,789	9	1.529

    - MK 323 provides greater temperature stability in the two lots compared

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- **Initial performance testing (continued)**
  - Accuracy and Ballistic Match
    - Testing conducted at 600 yards
    - 5 - 10 round groups out of two 36” accuracy test barrels

Accuracy Results		
100 Round Mean	**M33**	**MK 323**
Extreme Spread (in)	22.2	19.0
Standard Deviation (in)	5.9	4.9
Mean Radius (in)	7.2	5.9

    - Mean Point of Impact (MPI) taken from each 10 round group
    - 6.8 inch average disparity in vertical MPI across both barrels

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- **Initial performance testing (continued)**
  - Function and casualty

Function & Casualty		Temperature		
Test Weapon	**Mount**	**-25°F - 5°F**	**+70°F ± 5°F**	**+145°F + 5°F**
M2 Heavy Barrel #1	MK 93	1000	2000	1000
M2 Heavy Barrel #2	MK 93	1000	2000	1000
XM218, GAU 16/A #1	Aircraft	1000	2000	1000
XM218, GAU 16/A #2	Aircraft	1000	2000	1000
GAU 21/A # 1	Aircraft	600	1200	600
GAU 21/A # 2	Aircraft	600	1200	600
GAU 21/A # 3	Aircraft	600	1200	600

- All testing through the M2HB has been completed.
- Remaining weapons still to be completed
- Three cartridges at -25 F had a mid case split resulting in a weapon stoppage
  - Root cause has been identified and corrective action being taken

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- Function and casualty M2HB

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- Function and casualty GAU 21/A

Distribution Statement A – Approved For Public Release

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- **Initial performance testing (continued)**
  - Hot gun cook-off
    - 400 cartridges of M33 were fired in rapid succession through a M2HB to bring barrel temp to 600 F
    - MK 323 cartridge was chambered and allowed to soak for 5 minutes
    - If no cook-off occurred, round was fired.
    - A total of 5, MK 323 rounds were tested with no cook-offs occurring

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- **Future Events**
  - Conclude baseline performance testing
  - Environmental series testing and post test firings
  - Hazard Classification Testing
  - Pending successful completion of testing, WSESRB review and other associated full qualification activities

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- **Path forward**
  - Load alternative projectiles e.g., Tracer, AP, and API, SLAP, etc.)
  - Alternative calibers could be developed from the technology such as 5.56mm, 7.62mm, .300 Win Mag, and .338 Lapua Mag
  - Testing has indicated potential improvements in precision fire capability over brass case cartridges

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Questions?