SWING CHAMBER CANNON: TECHNOLOGY DEVELOPMENT FOR THE FUTURE COMBAT SYSTEM

PRESENTATION TO THE 37TH GUNS & AMMO SYMPOSIUM

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FUTURE COMBAT SYSTEM

- WHAT IS THE FUTURE COMBAT SYSTEM (FCS)?
  - “The Future Combat Systems will be a multi-functional, multi-mission re-configurable system of systems to maximize joint inter-operability, strategic transportability and commonality of mission roles including direct and indirect fire, air defense, reconnaissance, troop transport, counter mobility, non-lethal and C2 on the move. (Ref: FCS Public Briefings presented on Industry Day Ypsilanti MI on January 11, 2000.)
“LIGHT” GUNS

- PREVIOUS “LIGHT” LARGE CALIBER CANNON DEVELOPMENTS
  - 152 MM Gun on M551 SHERIDAN
  - 155 MM M776 on XM777 LW155
  - 120 mm XM291 on M1 THUMPER
  - 105 MM M35 on M8 AGS
  - 105 MM M35 on LAV 105
  - 105 MM M68A1E4 on STRYKER (BCT)
  - 90 MM Cockerill on the LAV
  - ARES 75 MM & 90 MM CTA

SWING CHAMBER CANNON IS PART OF THE MULTI-ROLE ARMAMENT & AMMUNITION SYSTEM (MRAAS)
FUTURE COMBAT SYSTEM & MRAAS

• FCS CONCEPT - HOW MRAAS FITS INTO IT.
  – MRAAS IS COMPOSED OF A GROUP OF TECHNOLOGIES BEING PURSUED BY TACOM ARDEC IN SUPPORT OF THE FCS, INCLUDING NEW AMMUNITION, AUTOLOADERS, ETC.

• MRAAS TEAM
  – FOCUS ON ARMAMENT COMPONENTS INTEGRATION
  – USE OF INTEGRATED DATA ENVIRONMENT IS ENSURING TIGHT INTERFACE AND TEAM OPERATION
  – GDLS CHOSEN AS PRIME CONTRACTOR TO DEVELOP WEAPON CONTROL SYSTEMS AND INTEGRATE THE TURRET MISSION MODULE.
MRAAS
TECHNOLOGY RISK ASSESSMENT

KEY FEATURES - LAUNCHER
♦ REDUCE ARMAMENT VOLUME/WEIGHT
♦ DECREASE AUTOLOADER COMPLEXITY
♦ INCREASES RATE OF FIRE
♦ UTILIZES HIGH STRENGTH GUN STEEL
♦ COMPOSITES & TITANIUM
♦ CONTROL SYSTEM W/ SENSORS

Risk to Attain

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RISK LEVELS
- HIGH
- MED/HIGH
- MEDIUM
- LOW/MED
- LOW

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MRAAS OBJECTIVES & CONCEPT

- MRAAS OBJECTIVES
- MRAAS CONCEPT
  - NOT A GUN BUT A ‘LAUNCHER’
  - CLEAN SHEET OF PAPER – AMMO AND ‘LAUNCHER’
  - BASED ON A NUMBER OF NEW/OLD TECHNOLOGIES
    - SWING CHAMBER ARES GUN
    - XM25 120 MM TUBE
      - COMPOSITE OVERWRAP
      - DYNAMIC STRAIN COMPENSATED
      - LONGER THAN M256
    - INTEGRAL MUZZLE BRAKE
MRAAS TECHNOLOGY THRUSTS

• MRAAS COMPATIBLE WITH SEVERAL GUN & LAUNCHER TECHNOLOGY THRUSTS BEING EXPLORED FOR MRAAS:
  – COMPATIBLE WITH ETC
    • ORIGINALLY DEVELOPED BY UDLP – TESTED ON XM291
  – COMPATIBLE WITH FIRE-OUT-OF-BATTERY (FOOB)
    • TESTED ON M35 TEST BED
  – COMPATIBLE WITH RAVEN
    • PM-TMAS SUPPORTED
    • TESTED IN 30 MM TEST BED
  – DYNAMICALLY TUNED SHROUD
    • PM-TMAS SUPPORTED

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AS PART OF MRAAS DEVELOPMENT, EXTENSIVE USE IS BEING MADE OF MODELING & SIMULATION AND NEW TOOLS ARE BEING DEVELOPED TO SUPPORT THIS:

- MUZZLE BRAKE COMPUTATIONAL FLUID DYNAMICS TOOLS (SUPPORTED BY PM TMAS & ARMY TECHNOLOGY)
- LINEAR/NON-LINEAR FEA
- DYNAMIC FEA
- COMPOSITE FEA

CASTING MODELS

PRO-ENGINEER ®

SIMBAD ® – TUBE DYNAMICS

MATLAB® & DADS®
MRAAS - DESIGN DETAILS

• DATA
  – 105 MM SMOOTHBORE TUBE
  – SWING CHAMBER BREECH
  – 270 VDC ALL ELECTRIC DRIVES
  – INTEGRAL CONTROL SYSTEM (SAVA)
  – CASE TELESCOPED AMMO (CTA)
  – DATA (FOR TRL 7 MODEL)
    • TIPPING PARTS WEIGHT 3000 lbs 1360 kg
    • RECOILING PARTS WEIGHT 2400 lbs 1089 kg
    • LENGTH (LAUNCHER) 256.8 in 6524 mm
    • WIDTH (LAUNCHER) 19.5 in 496 mm
    • HEIGHT (LAUNCHER) 12.4 in 316 mm
MRAAS - LAUNCHER

SWING CHAMBER BREECH MECHANISM
- Ø150.5 mm x 903 mm LONG CHAMBER
- ELECTRICAL ACTUATION
- SUPPORTS ETC IGNITION
- CHAMBER ROTATION MOTORS LOCATED ON NON-RECOILING PARTS
- INCLUDES A COMPOSITE TUBE SUPPORT FORMING PART OF THE TUBE SHROUD.

GUN TUBE
- 105 mm SMOOTH BORE *
- 5400mm TRAVEL
- ADVANCED BORE COATING
- COMPOSITE FOR STIFFENING
- INTEGRAL MUZZLE BRAKE
MRAAS - Critical Milestones

(Fiscal Year)

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- **Lab Test Fixtures**
  - Mechanism Operation
  - Control Systems
  - Power Requirements
  - Open/Closing Speed
  - Loads/Shock/Vibration
  - Gun Sealing

- **G1 - Gun on Hardstand**
  - Reduced Recoil Force
  - Lightweight < 3500 lbs

- **G2 - Gun in Turret**
  - Improved Recoil Reduction
  - Weight < 3000 lbs

Integrate G1 into Turret

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MRAAS
RISK MITIGATION ACTIVITIES

- SWING CHAMBER TEST FIXTURES
  - USED TO DEVELOP SOFTWARE
  - VALIDATE TIMELINE ACTIVITIES
  - VERIFY ASSEMBLY FIT(S)

- SEAL TEST FIXTURE
  - USED TO VERIFY GUN SEAL PERFORMANCE.
  - USES BENET ‘H-FI XTURE’

Insert

Seal Concept 1

Tube Rear Face
MRAAS CONCLUSION

MRAAS IS INTEGRAL TO A FUTURE COMBAT SYSTEM (FCS) THAT PROVIDES A LETHAL OVERMATCH