Moving Forward with Risk Reduction
US Army EQ-36 Program

19 November 2009

Agenda

- Background
- EQ-36 Physical and Performance Summary
- Technology and Benefit
- Conclusion

Background

- Since 2001, the Army has been developing S-band Active Electronic Scanned Array for Counter-fire Weapons location
- The current program is Enhanced AN/TPQ-36 (EQ-36)
- Risk reduction efforts may include use of EQ-36 or EQ-36 Prototype Multi-Mission Radar - Enhanced Multi-Mission Radar (MMR-EMMR)
- There are several possible areas of investigation that may provide insights for MPAR Working Group

Functional & Performance Requirements

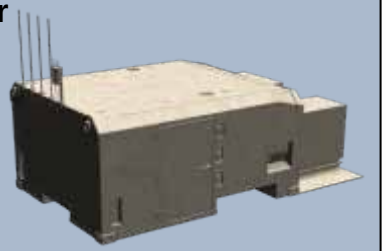
- Radar w/ Multiple Target Capability
  - –90° & 360° Modes of Operation
    - 90° Mode:
      - –Mortar: 500 m To 20 km
      - –Cannon: 3 km To 34 km
      - –Rocket: 5 km To 50 km (I1), 60 km (I2)
    - 360° Mode:
      - –Mortar: 3 km To 15 km
      - –Canon: 8 km To 19 km
      - –Rocket 8 km To 20 km
- Probability Of Location ³ 85% In Clutter-Free & Clutter Environments
- Hostile Weapon Location Accuracy
  - –90° Mode:
    - 50% CEP £30 m or 0.3% of Range
    - 90% CEP £80 m or 0.8% of Range
  - –360° Mode:
    - 50% CEP £100 m
    - 90% CEP £270 m
- Locate & Classify Projectiles
  - –≥90% for Mortars, Artillery (I1)
  - –≥90% for Mortar, Cannon, Rocket (Increment 2)
- Process At Least 50 In-Flight Or 6 Simultaneous In-Track Projectiles
- Discriminate And Provide Indication For Volley Fire
- Report And Localize Jam Strobes To £5 mil (10 db JNR)
- False Location Rate
  - –90° Mode:
    - £1 per 6 hr (I1)
    - £1 per 12 hr (I2)
  - –360° Mode:
    - £1 per 1 hr (I2)
- Simultaneous Missions:
  - –Hostile Weapon Location
  - –Hostile Weapon Impact
  - –Friendly Fire Registration
- Sidelobe Canceller (I2)

EQ-36 Physical Summary

- S-band Rotating Active Phased Array
  - Frequency = 3.1 – 3.5 GHz
  - Aperture = 2.0 m (H) X 1.6 m (W)
  - Elements = 1024 Low-voltage GaAs T/R Modules
- ATO Design Upgrade
  - Peak Transmit Power = 41 kW (pre-Loss)
  - Max Duty Cycle = 10.7%
  - Electronically scan ±45° Azimuth by ±30° Elevation
  - Mechanically rotate up to 30 rpm
- Ruggedized, Upgraded Receiver, Exciter, Signal & Data Processors
  - Conduction Cooled Electronics
  - SP & DP Firmware & Software Leveraged from ATO
- Operating Environment
  - Temperature = -32°C To +52°C
  - Wind = £52 mph Steady, Gusts >75 mph
  - Altitude = Sea Level to 10 kft
- Payload Weight
  - Mission Essential = 7,977 lb
  - Sustained Operations OCS = 5,035 lb
- Power
  - Mission Essential = 48.7 kW
  - Sustained Operations OCS = 8.6 kW

Design For Support

Shelter



- Ruggedized Laptops for Improved Reliability
- Multiple Access / Exits
- Self Contained Power and Climate Control Located Away from the Operating Space
- Common Computer Software Operating System
- Ergonomic Design for Ease of Access to Equipment
- Safety and Comfort of Soldiers Primary Design Consideration

Antenna

- Airflow and temperature Sensors
- Redundancy in Antenna Components
- Mechanically Keyed Mating of Components
- Captive Sliding Radome for Ease of Access
- No Special Tools Required
- Maintenance Platform for ease of access to all components
- Integrated handles for LRUs

RPES - SPES

- Components Easily Accessible and Replaceable
- Loads Centered over Bearing Cylinder
- Environmentally Sealed Actuators
- Redundant Lowering Capability Designed into Elevation System

- Automatic Leveling System
- Bearing Replacement without Special Lifting Device

Prime Mover

- Radar Weight Designed To Allow Armor Upgrade
- Ability To Disconnect from Radar
- Common MTV Supportable through Existing Army Support Infrastructure
- Radio Suite Integrated with Radar

General

- Allows Maintenance in MOPP IV or Cold Weather Gear
- Designed To Be Repaired in the Field
- Redundant Mission Critical Components
- Particle Separator Technology Eliminates Barrier Filters
- Built In Test (BIT) Sensors on All Radar LRUs
- Quick Disconnect Cable on Removable Components
- Common Captive Fasteners
- System Software Designed To Measure and Store Component Run Time and Component Failure Log
- Prognostic Sensor on Key Components

Generator

- Generator Faults Detected by BIT
- Backup Generator Available in Sustainment Configuration
- Capable of hot swapping

Technology and Benefit

- Potential Areas for Leveraged Risk Reduction
  - –Antenna improvements (e.g. Gallium Nitride (GaN) Power amps, dual polarization)
  - –Antenna control/beamsteering
  - –Radar mode development
  - –Signal processing
- Potential benefits to the Army
  - –Increased performance and improved Space, Weight, and Power (GaN)
  - –Improved Target classification (dual-polarization)
  - –"Mining" of meteorological (MET) data from EQ-36 for use to Army MET

Conclusions

- There may be sufficient overlap between MPAR and Army technologies and goals to warrant cooperation

- Potential exists for use of either or both of the EQ-36 Non-Recurring Engineering system or the EQ-36 Prototype (MMR/EMMR) for R&D