18262 – Minimalist Foreign Artillery Digitization
2016 Armament Systems Forum
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• Classification: UNCLASSIFIED

• Distribution A: Approved for Public Release. Distribution is unlimited.

• Type of Briefing: INFORMATIONAL
Introduction

- **BLUF:** It is possible to create a ‘good enough’ fire control system for foreign artillery, at an affordable price, if we sacrifice stringent US military requirements
Problem: Ukraine

• July 2015, “Lessons Learned” from the Russo-Ukrainian War by Dr. Phillip Karber
  – Artillery fire contributed to the vast majority of casualties on both sides
  – Use of UAV’s and counter-battery radars lead to significant counter fire against Ukrainian artillery units

• Ukrainian artillery is largely un-digitized with limited capability to shoot and scoot
Problem: Foreign Artillery
<table>
<thead>
<tr>
<th>Country</th>
<th>Military Budget</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>$581,000,000,000</td>
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<tr>
<td>China</td>
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<td>Russia</td>
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<td>Moldova</td>
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</tbody>
</table>
Meeting the Customer Needs

What they have now….

What they need…

What we’ve been trying to sell them

~$10,000

~$300,000
Minimum Requirements

• Pointing
• Position
• Basic Ballistics

TAKE ONLY WHAT YOU NEED TO SURVIVE.
### US Standard
- <1.0 mils accuracy
- High speed automatic pointing (50-200hz refresh rate)
- Highly automated
- Support navigation

### Minimalist
- ~3 mils accuracy
- Slower updates (10hz)
- Requires more soldier intervention
- “Just Points”

| ~$60-120k | ~$7k |
### US Standard
- <5 meters accuracy
- GPS aiding
- Highly automated
- Supports navigation
- Works anywhere on Earth

### Minimalist
- ~10 meters accuracy
- Start with GPS when available
- Cell tower triangulation when available
- Benchmarks/survey points
- Locally cached maps
- Manual steps
- Only has to work ‘at home’

#### Cost
- **US Standard**: $60-120k
- **Minimalist**: <$1k
Position: Benchmarks

Pre-positioned benchmark / survey point

Known distance X

Known distance Y
Locally cached map. Zoom in and ‘click’

“Eh I’m between 1st and 2nd”

“Just past the last tree”
### US Standard

- Many variables to consider:
  - Tube wear
  - Propellant lot
  - Propellant type
  - Propellant charge
  - Propellant temperature
  - Shell type
  - Projectile weight
  - Tube temperature
  - Muzzle velocity variance
  - MET data
  - Etc.

### Minimalist

- Just keep the bare minimum:
  - Propellant type and charge
  - Shell type
  - Basic MET
Mission computer

US Standard

- Many requirements:
  - Shock and vibe
  - Wash down
  - IA certification
  - Longevity
  - Milspec connectors
  - Reliability
  - Etc
- Drives cost and size
- Significant training requirement

$\sim$10-60k

Minimalist

- Keep it simple
- Minimal training / intuitive design
- Re-use commercial devices
- Rugged case

$\sim$300

DISTRIBUTION A: Approved for Public Release. Distribution is unlimited.
Existing Work: WULF

Low Cost: Total system cost <15k

Accurate weapon pointing: 2 – 3 mils

Improved accuracy: Lower collateral damage concerns

Cost Savings: ~1/10th overall cost vs current digital fire control

Lightweight: Pointing Device <1 lb, (comparable device 16 lbs)

System Weight Savings: 15lbs (200lb Weight Savings over MFCS-D)

Easily supportable: Modular design reduces logistic support requirements

Improved responsiveness: Setup time greatly reduced (2:30 min to < 1 min)

Repeat Rounds: WULF allows accurate, repeatable, and fast emplacement between rounds
Conclusions

• Artillery is key to land warfare
• Allies need the ability to rapidly emplace in order to survive and stay relevant to the conflict
• Allies cannot afford Western digital systems
• If stringent US/Western standards are relaxed, a cheap, ‘good enough’ system can be produced that our allies can afford
Questions

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