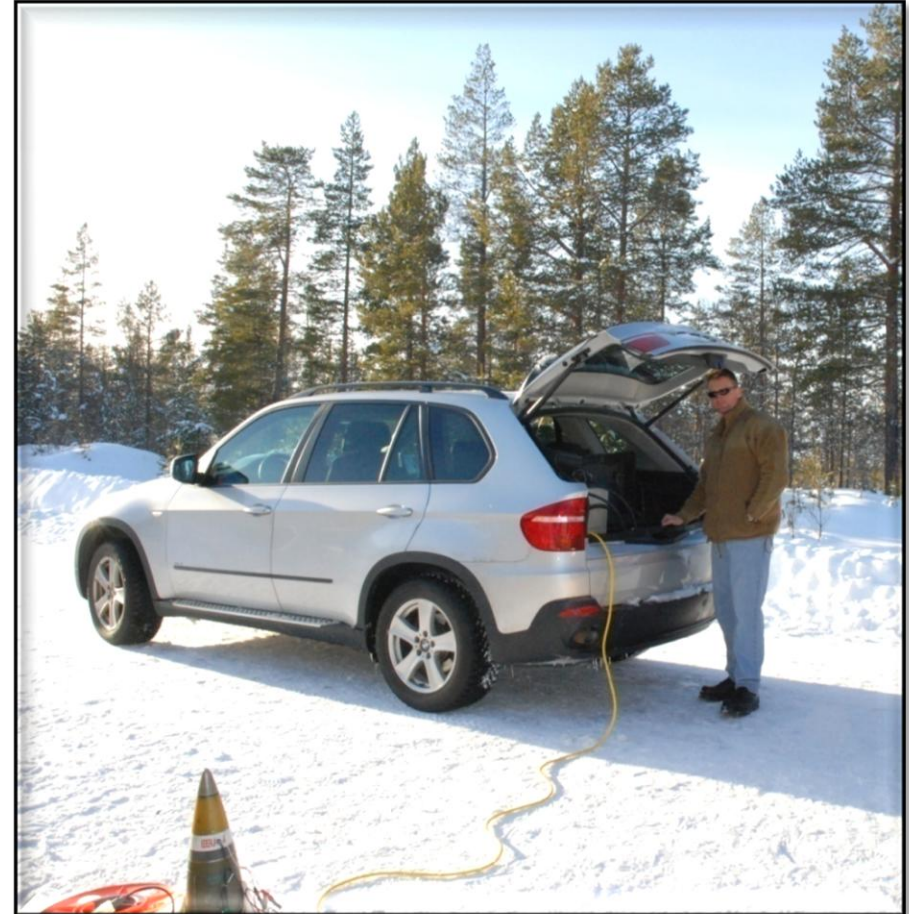


Justin Skaret

PRECISION GUIDED INDIRECT MUNITIONS OPERATIONAL EVOLUTION

Introduction

- Lead Flight Test Engineer for the Excalibur Guided Munitions Program at Raytheon Missile Systems
- Over seven years experience working in the guided projectiles technical arena
- Conducted hundreds of Excalibur test events both foreign and domestic including engineering evaluations of numerous developmental and production configurations
- United States Marine Corps Reserve attached to “N” Battery 5/14 as Liaison Team Communications Chief



What are PGM's? What is Excalibur?

The earliest form of the ballista is thought to have been developed for Dionysius of Syracuse, circa 400 BC – 2400 years of “Newtonian” Artillery... And Tactics

Hardware

Microprocessor controlled, Inertial /GPS guided projectile with sub-10 meter Circular Error Probable

Philosophically

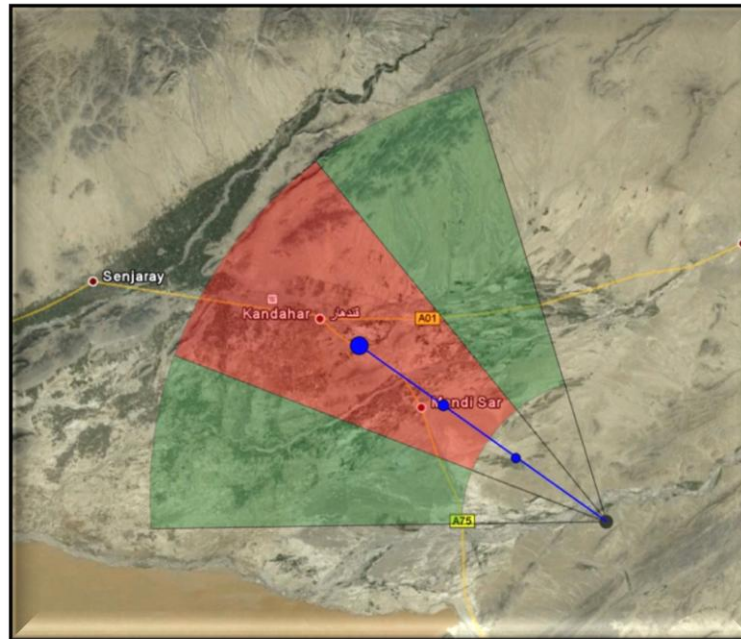
Excalibur is a fundamental evolution in the history of artillery. In the same way that Paveway™ revolutionized the utilization of air to ground ordnance, Excalibur redefines the domain of the possible with respect to artillery fires.



Unconventional Capability

Ballistic

1. Accuracy highly dependent on platform placement and stability
2. Accuracy/Dispersion worsens with range
3. Each new target requires unique firing solution (Q/E and Traverse, charge level, and/or Platform re-positioning)
4. Ballistic Trajectory trivial to trace back to platform (Counter Battery Fires)
5. Collateral Damage restricts operational value and availability



Precision Guided

1. Accuracy independent of platform placement or stability
2. Accuracy independent of range
3. Within guidance and control system performance footprint all target positions can be prosecuted
4. Off-Axis guided performance can significantly reduce Counter Battery effectively
5. Precision mitigates Collateral Damage opportunity

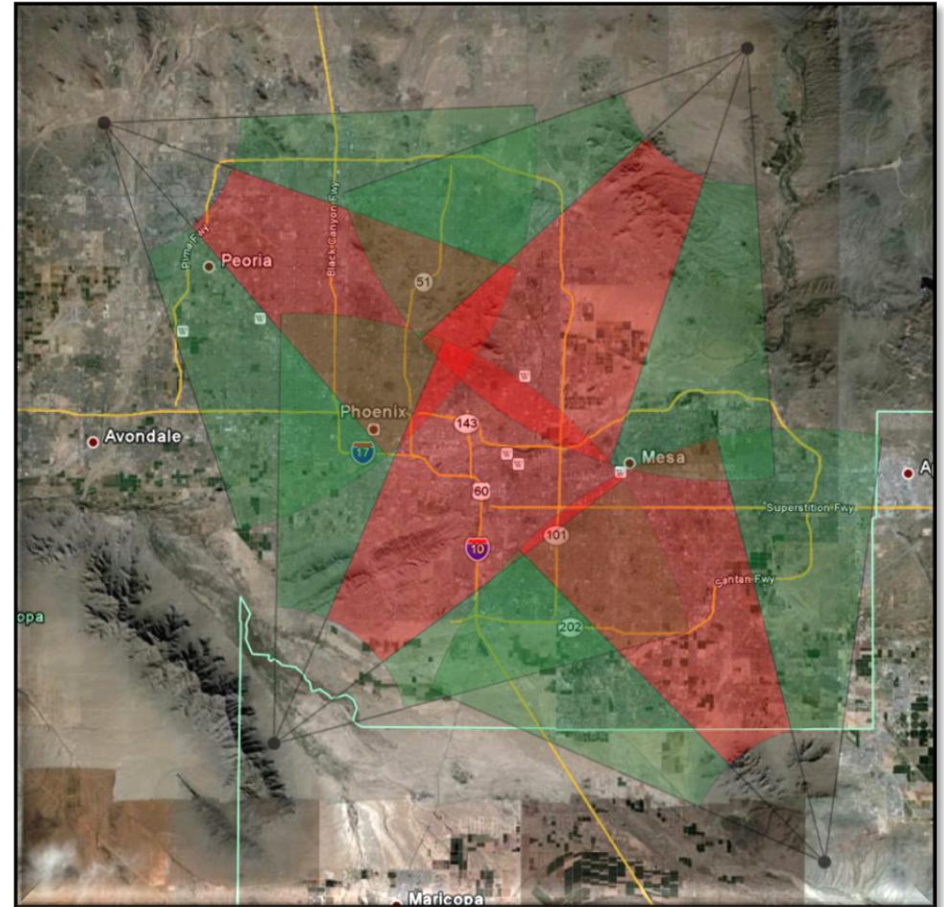
Minimizing Collateral Damage

Structure Target – Point Detonation Delay



Area of Regard – Coverage vs. Assets

- Total area covered with 1 Howitzer using PGM: ~1050 km²
- Total area covered 4 Howitzer using PGM: ~4000 km²
- 4 Guns can provide continuous coverage to an area the size of the city of Phoenix, Arizona
- Targets in red coverage areas can be engaged with out changes to Line of Fire of the firing Platform

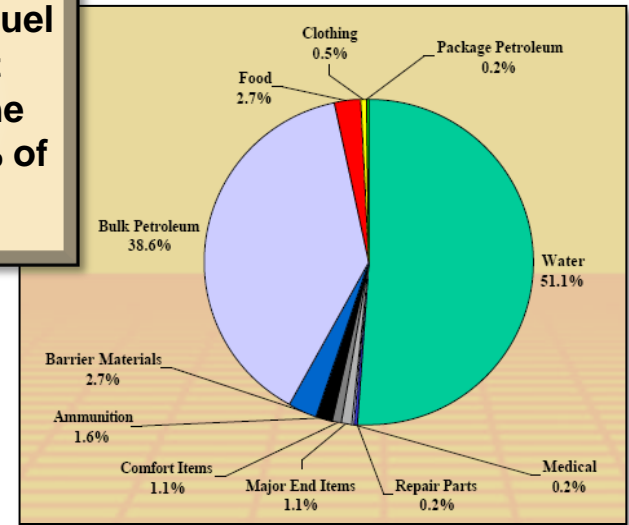


Asset Optimization – Minimum logistics

Aircraft fuel consumption, flight distances and On Station Times are a signification issue in currently theaters of operation



Next to Water, Fuel has the Most Tonnage on the Battlefield: 39% of the Demand



Persistent Availability - 24/7 All-Weather precision fires

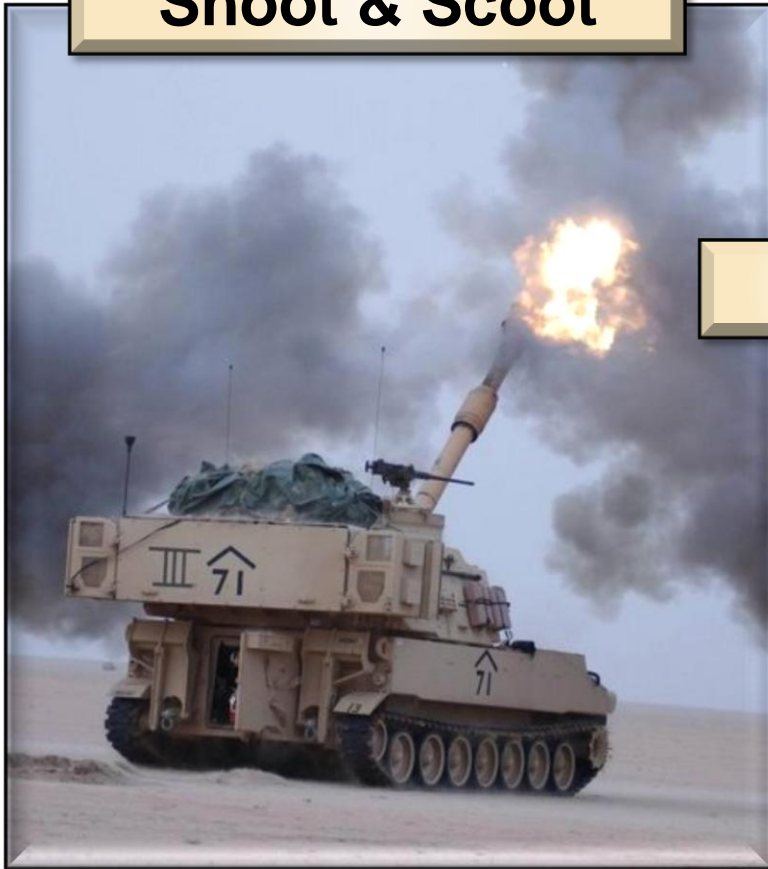
Maximum Area of Regard at Minimum Logistical overhead

Once placed continuing fuel demands negligible relative to airborne operations

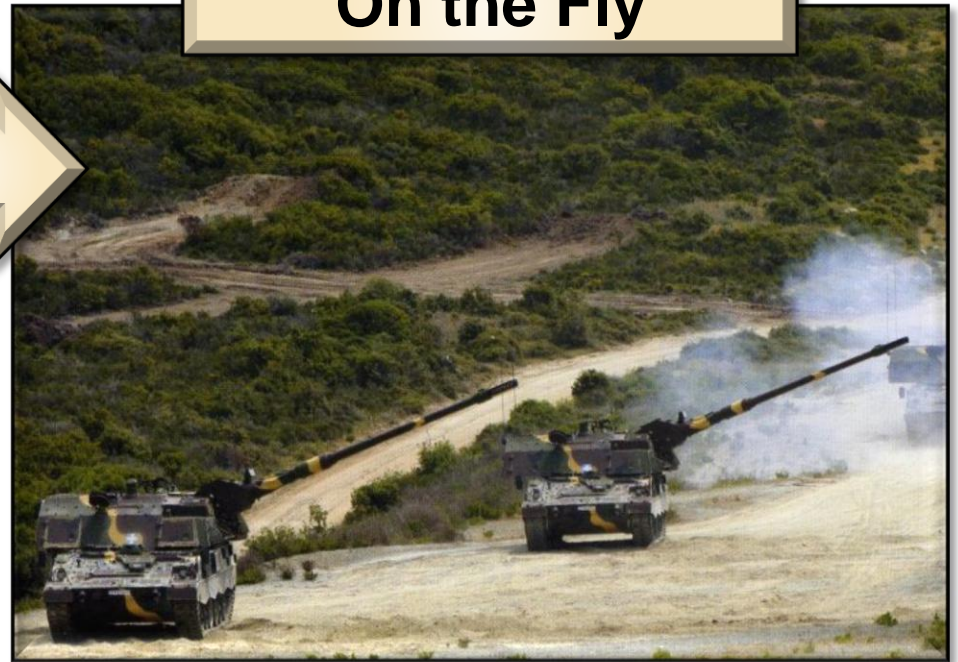
Minimizing Logistics Footprint Creates Mission Flexibility

CONOPS Concepts – Mobility

Shoot & Scoot



On the Fly



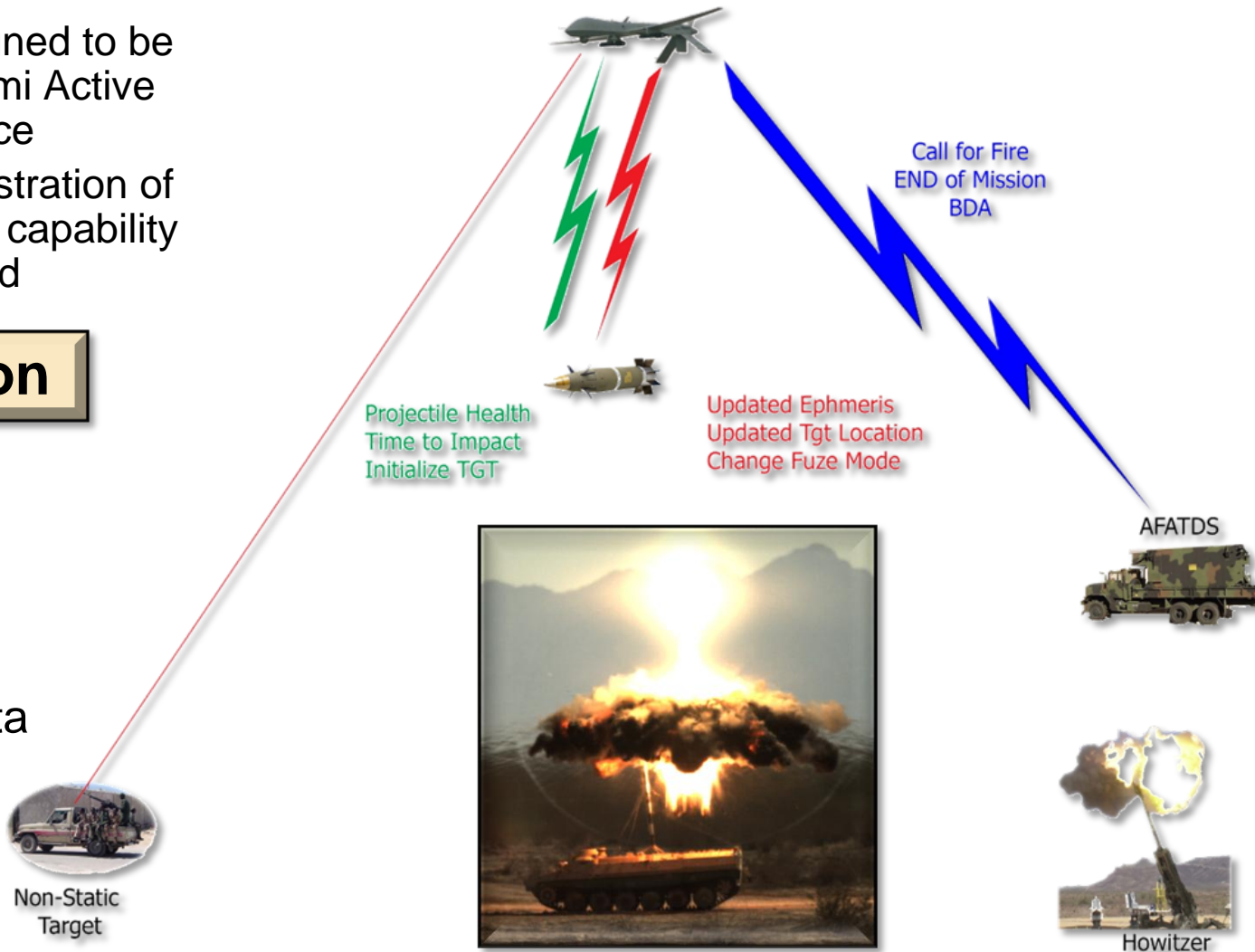
CONOPS Concepts

Non Static Targets

- Excalibur Ib is designed to be upgradable with Semi Active Laser (SAL) guidance
- Engineering demonstration of In-flight Retargeting capability has already occurred

Communication

- Imagery
- Status
- Target Info
- Met Data
- Real Time Data



Technologically Scratching the Surface

CONOPS Concepts

Helicopter/MV-22 Borne Operations

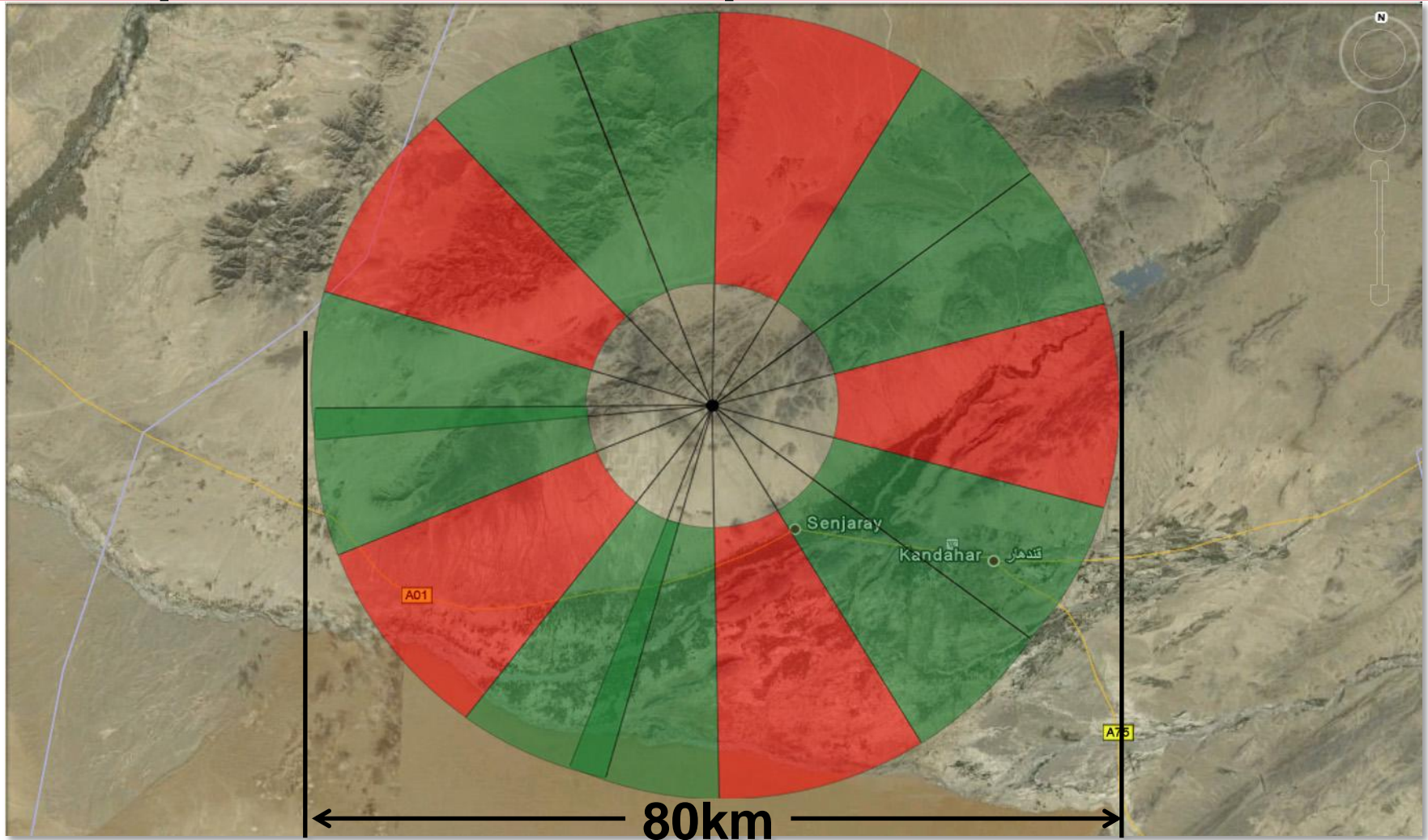
Equipment	Weight (lbs)	
Load Capacity of MV-22 (External)	15,000	Total
Load Capacity of MV-22 (Internal)	20,000	
M777	7,000	14,700
2 Pallets of M982 (18 Projectiles)	3,300	
MACS Charges and Primers	900	
Weight of Crew with Combat Load (5)	1,750	
Weight of Security Team with Combat Load (5)	1,750	



1 MV-22 has the Capability to emplace 24/7, Persistent, All-Weather, Precision Fires coverage of 4800 km2 in a single delivery

CONOPS Concepts

Helicopter/MV-22 Borne Operations



4800 km² of Persistent Coverage

Summary

- The accuracy, reliability and lethality of deployed guided munitions translate into far fewer rounds expended per engagement vs. conventional unguided munitions
- Continuous availability does not come with the fuel, hardware, or infrastructure demands of equivalent close air support. These reductions in logistics footprint without loss of unit combat effectiveness can be further exploited to create more cost and mission effective deployment models in the future
- We are just beginning to scratch the technological surface of what is possible with precision guided artillery munitions
- Future capabilities depend as much on innovative development of Tactics and CONOPS as they do on further development of the technology