INDIRECT FIRE
Precision Weapons, Challenges, and Risk Mitigation
Indirect Fire

- Commonly employed when a target is not within line of site
  - Obscured by geographic/structural features or curvature of the earth

- Uses
  - Fire into defilade
  - Fire out of defilade
  - Fire over forces or structures
Guns

- Guns
  - Weapons that use combustion of a propellant charge to generate high-pressure gas in a sealed chamber to accelerate a projectile
- Artillery Gun
  - Not man portable; caliber greater than 57 mm
  - Primarily used for indirect fire at range, sometimes used in direct-fire roles
  - Require platform or vehicle with high structural strength
Mortars

- Mortars
  - Smooth-bore, muzzle-loading, indirect-fire guns
  - Often only capable of firing at high-angle trajectories
  - Rugged, light, inexpensive, and often most responsive indirect fire support
  - Engage targets faster and at shorter distances than artillery
  - Less accurate than artillery
Rockets & Missiles

• Rocket Motor: tube in which fuel is burned, with an opening at one end, escaping gasses propel rocket forwards
• Artillery rockets are primarily unguided and typically inaccurate
  • Spin-stabilized rockets: short motor and short range
  • Fin-stabilized rockets: larger motor and payload
• Thin construction for light recoil and high explosive content
• Low barrier to entry, large use by non state actors
Precision Guided Munitions

- Munitions which can alter their flight paths to more accurately strike a target
  - Can be powered or unpowered
- Circular Error Probable
  - Less than 3 meters for “precise” weapon (USAF) or 1.3 meters (US Army)
  - Less than 10 meters for “accurate” weapon (USAF)
- PGMs include missiles, bombs, projectiles, and submunitions
  - Projectiles can be artillery, mortars, and bullets
  - Submunitions may be present in a missile or bomb (guided or unguided)
## Precision Guided Munitions

### Pros
- Increased precision!
- Reduction in collateral damage and friendly fire
- Reduce use of munitions
  - Diminishes need for cluster munitions
  - Decreased probability of UXO
- Surgical striking of HVTs
- Increased overall effectiveness of force

### Cons
- Increased cost over non-guided munitions
- Higher barrier of entry for training and procurement
  - Requires technical knowledge
- Require sophisticated battlefield management systems, storage and transport
- PGMs are not suitable for all traditional artillery roles
- PGM countermeasures exist
Chinese GP6 155 mm PGMs documented in Libya
Supplied to General Haftar’s forces by another state
Javelin ATGMs also documented
Not clear what other equipment was supplied
Risk Mitigation Strategies

Policies & Procedures
- Identify high-level goal of reducing risk of civilian harm
- Regulate use of indirect fires
- Weapon employment authorities at correct level

Targeting Process
- Improve target location, identification & development
- Better ISTAR capabilities/implementation
- Improved weapon-target matching (inc. PGM use)
- Robust collateral damage estimation (CDE) process

Battlefield Damage Assessments
- Go beyond just confirming desired effects (BDA vs. CA)
- Record effects on civilian populace for lessons learned
- Retain records
P&P: Policy Development

Political Input
- Decision made
- Policy brief
- International inputs?

Concept Development
- Analytical concepts
- Applied concepts

Doctrine
- In-service development
- Test & refine process

SOPs & TTPs
- In-service development
- Test & refine process

Rules of Engagement

External Forces
P&P: Weapon Employment Authority

• Who can give a ‘fire’ or ‘release’ command, and when?

• Authority is held at the highest level, and devolved to commanders in the field.

• Before any weapon is employed, it must be cleared by the command authority that holds delegated responsibility for the applicable use of force.

• Authority may be held at a higher organisational level for various reasons.
  • Collateral damage
  • High value assets
The Targeting Process

• Target identification and development
• Determining desired effects on target
• Weapon-target matching (‘weaponeering’)
• Collateral damage estimate (CDE)
• Battlefield damage assessment (BDA)
• Deliberate vs Dynamic targeting
• Planned Targets vs Targets of Opportunity
TP: Joint-level Deliberate Targeting

Commander’s Objective
- Desired end state (effect)
- Military intent and purpose
- Commander’s decision

Target Development
- Identify
- Characterise
- Prioritise

Capabilities Analysis
- Match desired effect/s on target to weapons/platforms
- Feasibility assessment
- Collateral damage estimation

Effects Assessment
- Conduct battlefield damage assessment
- Re-engage if necessary
- Commander’s decision

Planning & Execution
- Operation planned at appropriate level
- Operation executed by assets

Asset Assignment
- Match requirements with available assets
- Resource targets
- Commander’s decision
Other Key Factors

Policy, Doctrine, RoE, TTPs, etc. are influenced by a variety of factors

• Training
  • Weapon competencies
  • Targeting competencies (CDE, BDA, legal)

• Equipping Forces
  • Acquisition processes
  • Acceptance trials
  • Modelling weapon effects

• Sustainment of Forces
  • Survivability
  • Maintenance
  • Resupply
TP: Target Identification & Development

- Selecting & prioritising targets
- Positive identification (PID)
- Nature & disposition of target

- Special targets
  - Sensitive target
  - High-value target (HVT)
  - Time sensitive target (TST)

- Prohibited or restricted targets
  - No-strike list (NSL)
  - Restricted target list (RTL)
TP: Weapon-Target Matching

• Desired effect?
• What is available to achieve this?

• Weapon & fuze selection
• Method of engagement
• Accuracy/precision considerations
• Target composition
• Population density
• Time and angle of attack
• Weather, etc., etc.
Purpose & Design Intent

TP: Collateral Damage Estimation (CDE)

• Used to estimate unintended or incidental damage to persons or objects which are not the intended target, and are no otherwise lawful targets

• CDE is circumstantial
  • May be done rapidly in time-sensitive situations
    • i.e. Troops in contact or a target of opportunity is identified
  • CDE may be complex during deliberate targeting
    • Takes into account nature of target, population density, weather, delivery platform, etc.

• Feeds directly into weapon-target matching

• Operating in urban environments may mitigate an opponent's indirect fire capability
  • Some conventional forces conduct CDE before employing indirect-fire systems
  • Some forces may choose to employ indirect fires regardless
1. Can the target be positively identified?
2. Are there protected objects, non-combatants, or environmental concerns within the effects range of the weapon?
3. Can collateral concerns be mitigated by employing a different weapon or method of engagement?
4. If not, how many non-combatants are estimated to be killed or injured in the attack?
5. Are the collateral effects excessive in relation to the expected military gain?

**Expedient vs. deliberate CDE**
Weapon Employment

TP: Planning & Execution
Battlefield Damage Assessment

- Should be part of broader combat assessment
- Primarily (historically) geared towards assuring effects and confirming ‘kill’
- Planning
- Collection
- Processing & exploitation
- Production
- Dissemination
Questions?

Armament Research Services (ARES)
www.armamentresearch.com

N.R. Jenzen-Jones
Director
director@armamentresearch.com