Conducting Analysis of Alternatives for Directed Energy Systems

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Approved for Public Release
Distribution A
Counter-Electronics Program

Objectives:
Support the Counter-Electronics program in supporting an Analysis of Alternatives to produce the most effective CE solution.

Evaluation Factors:
- Functional Defeat Effectiveness
- Non-Lethal
- Assurance of Kill /BDA
- Collateral Effects
- Mission Survivability
Example Study Approach

1. Define and Characterize Operational Target Set
   - Buildings
   - Bunkers
   - WMD
   - Power Distribution / Transmission
   - POL Facilities
   - Vehicles
   - Etc…

2. Define Weapon System Concepts
   - CE Missile
   - CE Bomb
   - CE UAS
   - Kinetic Weapon Systems
   - IO Technique
   - Etc…
Example Study Approach

3. Define Criteria, Tactical Considerations and Measures of Effectiveness

- **Effectiveness.** What is Pk? Pdegrdn
- **Assurance.** How do you know it’s dead / Damage Assessments
- **Collateral Damage.** What are effects on Schools/Hospitals – Reconstruction Costs
- **Mission Survivability.** Will the platform get to the target range?
- **Environment.** What happens in weather?
- **Target Uncertainty** – What happens if we are unsure of where key components/target properties are?

4. Sensitivity Analysis

- Range to target – How close do we need to get?
- Attack geometry – Azimuth, etc
- Target Construct – Materials, Rebar,
- Target Layout – Windows, Doors, Computer, C2, power, HVAC location
- Environment – Humidity, rain, temperature, etc

5. Summarize Results & Analyze
Weapon & Building Characteristics

- How steep?
- How fast?
- How Compartmented?
- Construction Practices
- Location of equipment?
- Location of windows?
- How many pulses to achieve required damage?
- What azimuth?
- Range to building
- Guidance Accuracy
- Pointing accuracy?
Detailed target models:

- Window/Doors Location
- Computers Type / Layout
- Communications Type / Layout
- HVAC Type / Layout
- Power Type / Layout
- Wall Materials
- Roof Materials
- Rebar Configuration
- etc

Models to Accommodate Needed Details
**Description:**

We will need to know much detail about target construction and functionality. Power plants (or power stations) such as the coal firing plant shown here are numerous. Different types of these electricity production facilities include: nuclear, natural gas, coal, fuel oil, oil shale or bio-products.
Currant Creek Power Plant near Mona, Utah is a natural gas fired combined cycle electrical plant.

This is the Castle Gate Coal Plant near Helper, Utah.

Wind turbine in front of a thermal power station in Amsterdam, Netherlands.

The Susquehanna Steam Electric Station, a boiling water reactor.

Flue gas stack at GRES-2 Power Station in Ekibastus, Kazakhstan.

A hydroelectric dam and plant on the Muskegon river in Michigan.
Measures of Operational Effectiveness

- Deny Fuel Flow for x time
- Destroy Fuel Storage for x time
- Disable output for x time
- Destroy Permanently
## Key Characteristics

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<tr>
<td>4. Unit transformer (3-phase)</td>
<td>13. Feed heater</td>
<td>22. Air intake</td>
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<tr>
<td>7. Condensate extraction pump</td>
<td>16. Pulverised fuel mill</td>
<td>25. Precipitator</td>
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Power Transmission

- Environment
  - Potential reaction of power plant to specific type of damage
  - Effectiveness of certain munitions under different meteorological conditions
  - Do benefits outweigh detriments?

- People
  - Civilians
  - Collateral Damage
  - Legality

- Methods
  - Prevent power transmission

- Cost

Do benefits outweigh detriments?
Conclusions/Summary

Targets will need to be very detailed

Instrumentation will need to be netted across the target and non-intrusive/non-influencial

Target Construction will require Homework