Required Performance Metrics from Applications
Applications

- Blast
- Agent defeat
  - heat
  - chemical
  - pressure (or may be not?)
- Reactive Jets, EFPs, projectiles
  - Enhanced air blast
  - Enhanced breaching and penetration
- Propellants
  - Rockets
  - Guns
Applications Continued

- Reactive Jets, EFPs, projectiles
  - Enhanced water blast
  - Enhanced air blast
  - Enhanced breaching and penetration

- Initiators
  - matches
  - primers
  - SCB
  - Foil initiators
Applications Continued

- Reactive Structures
  - Bullets
  - Steel replacement

- MEMS
  - microthrusters
  - sensor
  - “Nano”-rocket
  - ballistic
  - in-situ switching
  - activation
    - valves
    - switches
    - drug administering
  - Active Denial (security)
General Metrics (Across Applications)

- Low cost
- Green
- Insensitive as possible
- Reliable
- Long shelf life
- Ease of processing/scaling up
Metrics

- **Blast**
  - models are guiding -> low ignition temp, high burning rate
  - Mechanics/Physics of Mixing (jets), momentum
  - System: higher impulse, peak pressure (< 30 ms)

- **Agent defeat**
  - Heat
    - Longer pulse is better >30 sec (much different than above!), 400C
  - Chemical
    - HF, HCl, nano metals, SiFx
    - Low collateral (goes awa)
  - pressure
    - Low gas producing (opposite of blast!)
Metrics

- Reactive Jets, EFPs, projectiles
  - Reaction Rates/ stoichiometry
  - Ignition timing
  - Enhanced water blast
    - Bubble formation and expansion rate
  - Enhanced air blast
  - Enhanced breaching and penetration
    - Reaction with target

- Propellants
  - Rocket – Isp, burn rate, ignition
  - Gun – barrel velocity, corrosion
Metrics

- Initiators (matches, primers, SCB)
  - Pressure (slappers >10ksi)
  - Reaction rate
  - Low jitter
  - High T, adequate particle size
  - Green (non-lead)
  - Reliability

- Reactive Structures
  - Bullets – matching properties
  - Steel - matching properties (>25% HE energy @10% power)
MEMS (micro thrust, sensor, nano-rocket, ballistic, in-situ switching)

- Impulse bit, easy to ignite, low quenching
- Isp less important
- Compatibility, shelf life
- Patterning, loading, scale, alignment, precision
- Actuation
  - Valves – pressure, speed
  - Switches – speed
  - drug administering – non toxic, low T
- Initiators – fliers need speed, mass, $p^2\tau$
- Active Denial (security) – destroy target electronics
  - Heat, chemical or shatter
- Energy – H2 generation, heat, reversible, low toxic, low T, high H2 weight %