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Directed Energy (DE) Intermediate Force Capabilities (IFCs): Relevant Across the Range of Military Operations

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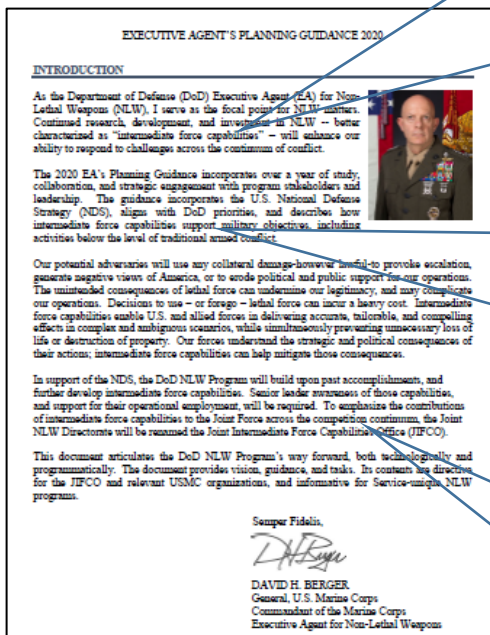
Background

- The U.S. Department of Defense's (DoD's) Non-Lethal Weapons (NLW) Program was created in 1996 out of impetus from Gen Zinni and his experiences in Somalia during Operation Restore Hope.
- National Defense Authorization Act directed the DoD to centralize developing NLWs.
- CMC was designated as the DoD NLW Program Executive Agent; Joint Non-Lethal Weapons Directorate established at Marine Corps Base Quantico.
- Program has achieved many accomplishments regarding advanced non-lethal, directed energy technology development and adoption of some capabilities into the Services.
- Over time, the Services have vectored their involvement in the program to policing and security force communities for advocacy and resourcing.
- Technology research under the auspices of the DoD NLW Executive Agent is leading to new capabilities with broader applications beyond law enforcement.

We have changed the conversation to **Intermediate Force Capabilities (IFCs)** to engender meaningful conversation with broader community bases within the Services.



DoD NLW Program Executive Agent Planning Guidance March 2020



“Continued research, development, and investment in NLW – better characterized as **“intermediate force capabilities”** – will enhance our ability to respond to challenges across the continuum of conflict.”

“This guidance incorporates the U.S. National Defense Strategy, aligns with DoD priorities, and describes how intermediate force capabilities support military objectives, including activities below the level of traditional armed conflict.”

“To emphasize the contributions of intermediate force capabilities to the Joint Force ... the Joint NLW Directorate will be renamed the Joint Intermediate Force Capabilities Office.”



Utility of IFCs Across Warfare Spectrum

“Gray Zone” competition dominates any conceptual spectrum of warfare and is ideally suited for IFCs.



Phases of Warfare



Competition Continuum

IFCs are a ***strategic risk mitigation investment*** that provide Warfighters tools to seize the initiative while competing below the level of armed conflict.



DE IFCs in Information Space



DE IFCs are a ***strategic risk mitigation investment*** that provide our Warfighters the tools to compete below the level of armed conflict without losing credibility in the ***information space***.



DE IFCs Provide Effects Without Destruction



- Mission accomplishment without undesired casualties and destruction of critical infrastructure.
- DE IFC implementation involves more than materiel; it is a new way of thinking about operational problems and crosses DOTMLPF.
- Must change operational mindset so that Services incorporate DE IFCs into regular training and planning cycles.
- With the proper tools and training, our Warfighters will be unbeatable across the competition continuum, not just in the “Dominate” phase.

VISION: Transform the National Security Enterprise by mainstreaming the planning and employment of IFCs to arm the Joint Forces with the fullest range of capabilities in support of National Security objectives.



Current vs. Advanced Technology IFC Initiatives/Concepts



Current Capabilities

Flashbang Stun Grenades



40-mm Munitions (Blunt Impact, Flashbang, RCAs)



Stingball Grenade



12-Gauge Munitions (Blunt Impact, Flashbang, RCAs)



Spike Strips



Acoustic Hailers



Tethered TASER (Short Range)

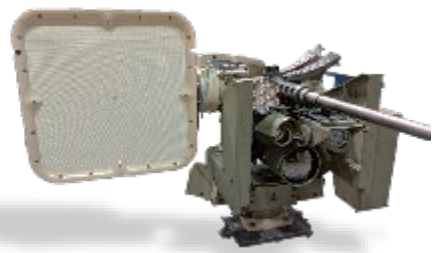


Human Effects Risk Characterization



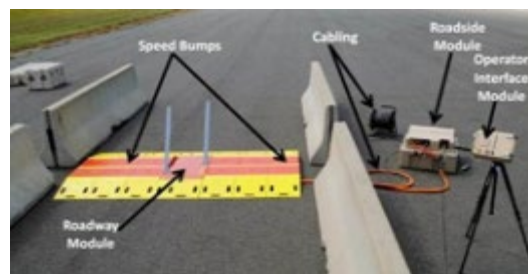
Next Generation Capabilities

Escalation of Force (EoF) CROWS Concept for IFC Kit (Projected Demo - FY23)



Non-Lethal DE Weapon - Size, Weight, Power Consumption, Thermal Cooling, and Cost Reductions (SWAP/C²)

Pre-emplaced Electrical Vehicle Stopper (Ongoing Pilot Program)



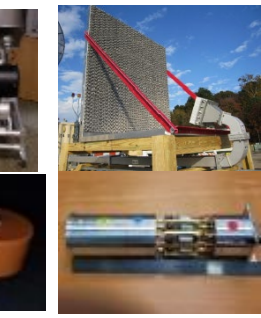
Dazzling Lasers (Long Range)



Occlusion Technology



Remotely Deployed, Vehicle Stopping Nets



Tetherless Human Electro-Muscular Incapacitation (HEMI) Munitions





Examples of DE IFC Technologies

Millimeter-Wave Active Denial System (Tube-Based)



*Current Form Factor
(Two Systems Exist)*

Millimeter-Wave Active Denial System (Solid State)



*Future Form Factor
USA - Focused Assessment
(Projected 1st QTR 2021)*

Long-Range IFC Payloads (DE & Non-DE Payloads)



High-Power Microwave (HPM) Vessel Stopper



*USCG DE Vessel Stopper
Afloat Military Utility Assessment*

HPM Vehicle Stopper



Prototypes Under Development

Laser-Induced Plasma



Air Plasma

*Audio / Physical / Thermal
Effects at Extended Range*



USMC/JIFCO SBIR/STTR Program



The Small Business Innovation Research (SBIR) and the Small Business Technology Transfer (STTR) program:

- Acquisition-driven process with strong technology pull
- \$300M+ DON annual funding supporting small business innovation/research

Current Plans

• Feasibility (Feasibility Study)

- Focused Enhanced Acoustic-driver Technologies (FEAT) – 123 dB acoustic drivers (Source Selection) – Phase I (2021)
- Improved Laser-Induced Plasma Effects (LIPE) Device - ultra-short pulse lasers – awarded Phase II – FY20 prototype
- Optimized Short Pulse Source - Higher-Power Microwave Vehicle Stopper – (STTR – Solid-State HPM) – Phase II awarding (FY21)
- Focused Directed Energy Antenna Systems (FoDEAS) – compact/lightweight/high gain - wideband HPM antenna – Phase II awarding (2022)
- FY21 U.S. Army XtechSBIR -ASA(ALT) – Non-Lethal Driver Defense SBIR (Two Phase 1 SBIRs awards in Jan/Feb 2021)
- **FY21-22: DIRECT to Phase II Compact (5-20 kW) Genset; IFC payload; broadband compact HPM source**

• Demonstration (Technology Development & Prototype Demonstration)

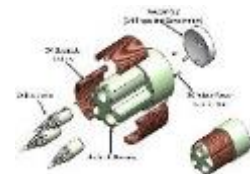
- HEMI Munition – 12 ga. – (in process) – FY22 prototype

• Prototype Testing & Evaluation, Technology Demo & Validation

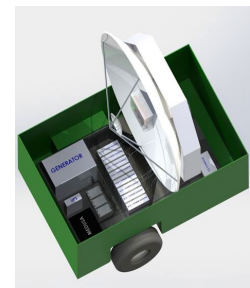
- Recuperated 480 lb – 300 kW High-Power Density Generator for directed energy weapon (DEW) systems - Candent (delivered & tested – Aug 2021) – includes Mezzo International Inc. micro-tube heat exchanger design - previous SBIR

• Commercialization (Transition to Acquisition Program)

- Generators support JIFCO NL DEW prototype & DEW community.



12 ga. HEMI Munition



Solid-State HPM SSTR



FoDEAS – wideband HPM Antenna
Light Weight High Power Density Generator – Candent + Heat Exchanger



Laser-Induced Plasma



FEAT – Acoustic Drivers



DE IFC Vignette: South China Sea



EXPEDITIONARY ADVANCED BASED OPERATIONS (EABO):

- U.S. Marines conduct bilateral training with Philippine forces.
- Exercise conducted on disputed Thitu Island, Spratly Archipelago (claimed by the Philippines, PRC, Vietnam, and Taiwan).
- Chinese government expresses displeasure at exercise.
- **Mixed fleet of armed Chinese Coast Guard and civilian fishing vessels attempt to disrupt the exercise.**



Long-Range Dazzling Laser Producing Glare on Vessel Wheelhouse

DE IFCS:

- **Dazzling Lasers and Focused Acoustics** from both afloat and ashore forces employed to provide long-range hail and warn to Chinese vessel operators impeding safe operations (1st form of EoF).
- **Active Denial Technologies (ADTs) Counter-Personnel** employed to deter aggressive actions of Chinese fishing vessels around the island.
- Long-range (multikilometer) **Non-Lethal LIPE** employed to provide unambiguous hail and warn and suppressing effects to deter aggressive actions.
- **DE Vessel Stopper** - HPMs affect the operational performance of outboard motors.
- **DE IFCs** employed against small unmanned aerial systems create safety of flight issues to U.S. aircraft.



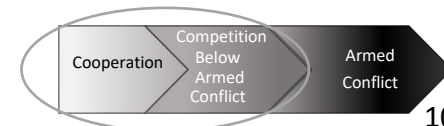
Active Denial System (ADS)



Radio Frequency (RF) Vessel Stopper

OPERATIONAL IMPACT:

- Boost versatility and adaptability across the competition continuum.
- Expand decision time and space in ambiguous situations.
- Build partner capacity with low-risk tools and increase costs to competitors.
- Support proactive operations while reducing risk in information space.





DE IFC Vignette: Urban Operations



MANEUVER TO OBJECTIVE:

- Coalition forces fighting insurgents in megacity.
- Joint Forces must maneuver through urban areas to reach objectives and conduct daily resupply.
- Non-combatants number in the tens of thousands and attempt to lead normal lives despite constant bloodshed.
- Civilian vehicle and foot traffic impede movement of friendly forces.



EoF CROWS

DE IFCs:

- **Dazzling Laser and Acoustic Hailing Device** mounted on **EoF Common Remotely Operated Weapon Station (CROWS)** warns pedestrians/vehicle operators to give way.
- Long-range (multikilometer) **Non-Lethal LIPE** employed to provide unambiguous hail and warn and suppressing effects for crowd control and deter aggressive actions.
- **Vehicle-Mounted, Solid-State Active Denial Technology (SS-ADT)** clears roads of non-compliant individuals.
- **Vehicle-Mounted RF Vehicle Stopper** protects friendly forces from suicide vehicle-borne, improvised explosive devices and provides anti-access/area denial from threat vehicles rapidly approaching entry control points and our maneuvering forces.
- **DE IFCs** employed against small unmanned systems approaching our dismounted forces.



Solid-State ADT

OPERATIONAL IMPACT:

- Help to prevent unnecessary destruction and loss of life.
- Expand decision time and space in ambiguous situations.
- Support proactive operations while reducing risk in information space.



RF Vehicle Stopper





DE IFC Vignette: Wet Gap Crossing



USA / USMC

SCENARIO: WET GAP CROSSING



- European Theater of Operations – Competition Below Armed Conflict.
- Heavy Brigade Combat Team (HBCT) mission requires wet gap crossing due to weakened bridge infrastructure by “little green men.”
- Thousands of civilian refugees fearing open hostilities seek food, medical care, and safety.
- Small unmanned aerial vehicles are regularly employed by state and non-state actors to observe and harass operations.
- The HBCT commander faces the challenge of maintaining tempo without alienating the local population.



DE IFCs:

- Soldiers order the crowd to stay away from bridging operations using an **acoustic hailing device (AHD)** in local dialects.
- Some attempt to approach the bridge as the final sections are moved into position, completing the span. Repeated attempts to stop them with voice commands fail.
- Soldiers engage non-compliant individuals with the **ADS** to deter their action. ADS creates a brief intolerable heating sensation on targets, stopping their attempt to breach the perimeter.
- Unmanned aircraft system (UAS) with an unknown payload is detected approaching the bridging operation.
- **ADS** engages the UAS, bringing it down a safe distance from the bridge.
- Unknown civilian vehicle approaches the bridge.
- Soldiers warn the driver with their **CROWS-mounted dazzling laser** and **AHD**.
- When vehicle fails to stop, Soldiers engage with **vehicle-mounted RF vehicle stopper**. The RF vehicle stopper transmits a high-power RF beam that neutralizes and stops the vehicle’s engine.

OPERATIONAL IMPACT:

IFCs improve Joint Forces' ability to maintain effective OPSTEMPO during competition below armed conflict by:

- Enabling proportionate and discriminate use of force
- Reducing risk of unnecessary escalation
- Addressing unpredictable and ambiguous threats
- Minimizing civilian casualties and collateral damage
- Building partner capacity
- Increasing the competitive space



EMERGING IFCs featured: ADS (Counter-UAS); RFVS; CROWS
CURRENT IFCs featured: AHD; ADS (Counter-Personnel);



“Fear-of-the-New” and “First-Use” of DE IFC Weapons Study



- DE and NLW Community of Interest with support from OSD (R&E) requested study in FY21/22 via a DE Federally Funded Research and Development Center (FFRDC) performer.
- This “Fear-of-the-New” and “First-Use” of DE IFC Weapons Study will:
 - Make recommendations to the DoD on how best to make progress against the last three recommendations from the “2007 Defense Science Board Task Force on Directed Energy Weapons.” The study will include the following:
 1. Development of an authoritative single source DE Joint Munitions Effectiveness Manual - backed by wargaming and DE prototype experiments, demonstrations, and assessments
 2. Assessments of threat DEWs, analyses of DE IFCs throughout the force continuum, and analyses of optimized DE IFC and lethal DEWs in current and future warfare.
 3. Development of a new DoD DEW Strategic Information/Communication “Campaign” Plan that rids the DEW “Death-Ray” myth, thwarts the “Fear-of-the-New” for DEWs, and allows and even compels senior DoD leadership and the U.S. public to demand “First-Use” of these often Non-Lethal – Low Collateral Damage DEWs.



SUMMARY



- We have changed the conversation to IFCs.
- DE IFCs enable the Warfighter to compete across the competition continuum without losing in the information space.
- Ultimate goal of DE IFCs is mission accomplishment without unnecessary destruction that initiates or prolongs expensive hostilities.



U.S. embassy under attack in Baghdad



U.S. Navy ships transit the Strait of Hormuz



DefenseNews
COUNTERING 'LITTLE GREEN MEN':
PENTAGON SPECIAL OPS STUDIES RUSSIA
'GRAY ZONE' CONFLICT
May 15, 2017