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Produced for/Distribution List: Major Jay Weinbender and Major Shawn Smith, Plans and Capability Development (P&CD), Influence Activities Task Force (IATF).

Scientific Letter

Non-kinetic targeting risk assessment methodology (NKTRAM)

Background

The purpose of this Scientific Letter (SL) is to propose a non-kinetic¹ (i.e., Influence Activities and Information Operations) equivalent of the Collateral Damage Estimation Methodology (CDEM), which underpins the planning and application of kinetic / munitions-based weapons in the joint targeting process. The objective of the Non-Kinetic Targeting Risk Assessment Methodology (NKTRAM) is to provide Joint Targeting and Effects (J TGTs & E) staff with a structured and replicable methodology to support the identification and management of risks associated with non-kinetic engagement, in particular but not limited to casualties and damage to infrastructure that may result in harm, injury or undue hardship and suffering to civilian / non-combatant populations. At present, the Canadian Armed Forces (CAF) and the North Atlantic Treaty Organization (NATO) does not possess a methodology for calculating risk associated with non-kinetic engagement. This SL is in response to a specific request from the Influence Activities Task Force (IATF) to fill an identified gap in the joint targeting process.

Statement of results

Targeting is defined as the “process of selecting and prioritising targets and matching the appropriate response to them taking account of operational requirements and capabilities.” In essence, targeting involves the identification, selection and prioritization of targets and / or target audiences² and matching an action (i.e., a kinetic or non-kinetic input) directed towards the target in order to achieve a designed output (i.e., the tactical outcome of the action on the target) which generates or supports a desired effect (i.e., the aggregation of outputs) across the battlespace.³ Targeting takes into consideration the

¹ It should be noted that non-kinetic does not imply non-lethal. Non-kinetic or kinetic refer to the system input; generally, non-munitions or munitions based weapons or activities. Lethal and non-lethal refer to the intentional tactical output of the engagement; that is, whether or not the strike was intended to result in death. For example, a kinetic / non-lethal strike may be the destruction of an unoccupied building through the use of precision-guided munitions. In contrast, a non-kinetic / lethal activity may be the dissemination of a message that is designed to result in the death of an intended target.

² A target is generally defined as an entity, object, structure, person or organization considered to engagement. Similarly, a target audience is defined as an individual or group selected for influence or attack by means of psychological operations. In other words, the use of the term target audience is specific to psychological operations and, more generally, influence activities. Target audience implies non-kinetic engagement, whereas target implies either kinetic or non-kinetic engagement. It is acceptable to use target in place of target audience.

³ It should be noted that the term effect is often inappropriately applied in the context of targeting. The tactical output of an action, such the destruction of a tank, is not an effect in-and-of-itself. The effect is achieved, or



operational requirements and strike capabilities of the actor, as well as an assessment of the effectiveness of the action to generate the desired effect, and targeting occurs at all levels of conflict (tactical, operational, and strategic).

At present, there is no clear definition of, or responsibilities for, non-kinetic (i.e., influence activities / information operations) targeting, nor is there doctrine, policy, or tactics, techniques, and procedures (TTPs) or universally subscribed analytical methods or frameworks to guide activities in this domain. This has been noted across operations and exercises over the last decade, in particular at the high tactical / low operational level.⁴ In addition, there is not a non-kinetic equivalent of CDEM to support target development, and the non-kinetic equivalent of Battle Damage Assessment (BDA), which can be loosely interpreted as Measures of Effectiveness (MOE), remains — for the most part — under-developed.⁵ For example, the calculus for conducting CDEM for kinetic engagement (e.g., dropping a bomb on a target) is well defined, structured, and scientifically validated. Based upon the physical characteristics of the target and an advanced understanding of the weapon system, CDEM can be performed with a high degree of accuracy, and mitigations put in place to minimize collateral damage. This is also true for the methodological approach used to assess the damage to a target after a kinetic engagement (e.g., BDA); that is, the percentage and criticality of damage, and whether the desired outcome was achieved, can be accurately measured, as well as the requirement for re-strike can be determined. However, it is not the same for non-kinetic targeting. In fact, success in the non-kinetic domain is often less guided by mathematical formula and structured techniques, and more often guided by operator skill and experience (i.e., based on intuition and heuristics).

Another issue is that of joint targeting integration and synchronization.⁶ In essence, targets are either considered for kinetic or non-kinetic engagement, but not both.⁷ Once a determination has been made to kinetically engage a target, complementary non-kinetic activities (or activities designed to mitigate negative or enhance positive consequences from a kinetic engagement) are generally not factored into the targeting development process – and vice-versa. For example, if it has been determined to destroy an enemy Command and Control (C2) node using a kinetic strike, non-kinetic activities (such as

realized, through the aggregation of tactical outputs across the battlespace. In some, albeit rare, circumstances, the effect may be achieved by the output of a single tactical action.

⁴ In particular, but not limited to, the employment of a Division or Combined Joint Inter-Agency Task Force (CJIATF)

⁵ It was noted in the JOINTEX series of exercises that the methods used for kinetic CDEM / BDA were not applicable or easily translatable to non-kinetic engagements. For example, the CDEM is a five-step process with numerous sub-steps. It was noted that, while Steps 1 (Target Validation / Initial Analysis) and 5 (Casualty Analysis) generally lend themselves to non-kinetic targeting, Steps 2 (General / Target Size Analysis), 3 (Weaponing Analysis) and 4 (Refined Analysis) are unrelated or practically impossible to apply to the non-kinetic domain, at least until non-kinetic weapons effects tables have been developed.

⁶ By integration, the author means simultaneous action using both kinetic and non-kinetic activities on a single target or target set, whereas synchronization implies the application of kinetic and non-kinetic activities on different targets, usually separated by time and space. Integrated and synchronized targeting may also be called full-spectrum targeting, or FSpecT.

⁷ In a service paper, entitled *Holistic Targeting*, Gregory Radabaugh, Director the United States Joint Information Operations Warfare Centre (JIOWC), notes an “artificial barrier exists between lethal and nonlethal measures in the joint targeting process,” which “seriously impairs effects-based holistic targeting, complicates the overall planning effort with dual-channel targeting considerations, and yields less than optimum set of options to the commander for decision making.”



messaging) are typically not factored considered.⁸ The result is the development of ‘silos of excellence’, and as well as missed opportunities for reinforcement or amplification of designed tactical outcomes and the generation of effects.

To overcome the deficiencies identified above, and based on lessons-learned from the JOINTEX series of exercises as well as an assessment of allied non-kinetic CDEM prototype,⁹ the attached (see Annex A) 3-step methodology has been developed for the purpose of guiding non-kinetic target development. However, a number of things should be noted:

- While the NKTRAM is based on the CAF and allied experience and input, it has not been validated. As such, the NKTRAM should be considered a ‘working’ or ‘starter’ methodology that will be refined and further developed to meet CAF joint targeting requirements.¹⁰
- The NKTRAM should not be considered an exact replica of the CDEM nor should it be used in the same way, rather it is an analogue (i.e., it is similar to). In essence, while the NKTRAM differs in structure and appearance, it serves the same general purpose, and that is to identify and manage risk associated with a strike or engagement.¹¹ At this time, it is not possible to develop an exact, 5-level non-kinetic version of the CDEM. This is due to a lack of validated scientific principles and theory underpinning how we think about the non-kinetic engagement space. The challenge the defence S&T community currently face is: How do we weaponeer influence activities or information operations, such as a psychological operations message conducted via conventional delivery methods (radio or television) or social media, and how do we calculate the blast radius and effects zone of a message or a key leader engagement? Presently, non-kinetic weapons tables, along with prescribed values and formulas for calculating outputs and effects, do not exist. As a result, expectations for calculating and managing risk for non-kinetic targets needs to be different than those for kinetic targeting -- at least until the science underpinning this area is more fully developed.
- While the NKTRAM is a structured framework, calculations regarding potential impact and risk remain largely (although not entirely) based on operator experience and heuristics.

⁸ Although there are excellent examples of well-integrated kinetic and non-kinetic targeting, such as by Israel during Operation PROTECTIVE EDGE (July 2014), the lack of holistic targeting was notable during the JOINTEX series of exercises.

⁹ An allied nation has developed a ‘working’ risk assessment matrix for use as a non-kinetic CDEM. This risk assessment matrix is in the prototype stage and is classified. As such, it will not be discussed or identified within this SL. In November 2013, the IATF red teamed the prototype assessment matrix, using the Joint Ex scenario, to determine whether it should be incorporated into CAF doctrine. While the risk assessment matrix was considered useful and “a good step forward,” it was determined by the red team to be too narrowly focused on quantified factors such as casualties and did not adequately take into consideration abstract and qualitative notions of negative socio-cultural and psychological consequences of engagement.

¹⁰ It should be noted that this is a ‘working’ or ‘starter’ methodology for conducting non-kinetic casualty damage estimation and should not be considered an end-state. As such, terms and definitions used may be refined or adjusted, as appropriate.

¹¹ Whereas the CDEM has five progressive and ascending levels (which may not be completed, depending upon the risk calculation), the NKTRAM is a 3-step process in which all three steps must be completed in order to generate a risk assessment. In addition, the CDEM either assesses risk as being low or high. The NKTRAM differs in that a range of risks, from very low to very high / extreme may be identified.



- The NKTRAM is not a stand-alone or one-stop analytical framework. Like that of the CDEM, it requires the outputs from the Target Systems Analysis (TSA) and the Target Audience Analysis (TAA) portion of the joint targeting process in order to ground the risk assessment. In other words, the TSA / TAA will inform the NKTRAM (in particular, Steps 1 and 2).
- A detailed user-guide for using and applying the NKTRAM will be developed in the future. This user-guide will support Joint Targeting staff in the development of non-kinetic targets.

Conclusion

In response to a request made by the IATF to develop a structured framework or approach to ground non-kinetic target development, and based upon lessons learned and input from CAF and allied nations involved in joint targeting, the attached Non-Kinetic Targeting Risk Assessment Methodology has been developed in is proposed for field-testing and refinement. Like that of the CDEM, the purpose of the NKTRAM is to support the identification and management of risk, as well as to support decision making, associated with the planning and execution of non-kinetic activities.

Prepared by: Matthew A. Lauder, DRDC – Toronto Research Centre

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Attachments

Annex A: Non-Kinetic Targeting Risk Assessment Methodology (NKTRAM)

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Annex A: Non-Kinetic Targeting Risk Assessment Methodology

Step 1: Target Validation / Initial Analysis

Target / Target Audience	Identify or describe the target of the activity and functionally characterize the target
Target Location / Boundaries	Describe the geographic and / or relational and temporal boundaries of the target
Positive Identification (PID)	Identify whether PID has been achieved or not
ROE Check	Identify the relevant ROE
Activity	Description of the activity (i.e., the means of engagement)
Dominant Tactical Hazards	Identify any hazards, dangers or risks associated with the activity
Tactical / Desired Effect(s)	Describe planned (desired / intended) tactical effect(s) / outcome of the engagement
Overall Effect	Identify the overall effect the activity supports



Step 2: Refined Analysis - PMESSI+PT / ASCOPE IMPACT ASSESSMENT¹

Factors	Political	Military	Economic	Social	Infrastructure	Information	Physical Environment	Time
Areas	District, Boundary, Party affiliation areas, tribal/religious sects' areas	Groupings, force structure, area operations of regular and irregular forces	Markets, economic zones, trade routes, business zones	Cultural locations, sports arenas, religious sites, other gathering places	Critical infrastructure, including power generations, dams, waterways, main roads, hospitals, schools, etc.	Formal and informal news media and information relays, including TV, radio and Internet provider areas, local gossip	Naturally bounded geographic area due to mountains, forests, water, or other change in terrain	Time zone, but also local understanding and appreciation for time
Structures	Political or advocacy building, offices and institutions	Police and military facilities, insurgent or enemy facilities	Shopping malls and businesses	Religious structures, event venues, popular buildings, including entertainment facilities (clubs, etc)	Roads, bridges, electric lines and generations facilities, public works buildings	Cell, radio, and TV towers / broadcast facilities; informal and formal networks	Dominant natural and manmade structures	Facilities that are used at a specific time of day or year, such as religious buildings or meeting places
Capabilities	Political, religious and social leadership, as well as insurgent or enemy leadership, tribal, religious leaders	Police and military capacity and capability, as well as insurgent or enemy capability	Ability of banking and economic sector to withstand stressors, and other shocks	Strength and ability of key family, tribal, clan or other social and religious networks and affiliations	Ability of government (formal or informal) to maintain roads and critical infrastructure	Literacy rates, availability of and access to media, media penetration rates, informal and formal information networks	Farm and natural resource production, mineral wealth	Ability of leaders and workers to perform on time
Organization	Political parties, advocacy groups, insurgent and enemy groups	Force structure and organization of military and police, as well as insurgent or enemy forces	Local business or market associations	Family, clan, tribal, sport, educational and other identity affiliations	Regional and municipal government, informal governance structures, constructions companies	Formal and informal information powerbrokers and networks	Urban and rural planning, social diversity and demographics, areas of stratification	Event planning, event structure, linear versus non-linear
People	Formal and informal political and social leaders, community leaders, clan and tribal elders	Leaders and leadership structure, powerbrokers and key influencers, including insurgent and enemy forces	Bank owners and managers, landowners, and other formal and informal economic leaders	Religious and non-religious leaders, influential families, and other charismatic community members	Builders and construction company owners, power and works management and owners	Formal and informal media and information network owners and managers	Farm owners and landowners, relationship between families and geographic area	Leadership or organizers of key events linked to the calendar, events that commemorate a person or group of people
Events	Elections, council meeting and other political meetings, speeches and other political or politicized events	Change of command, parades, key operations, formal and informal events (e.g., TGIT)	Business sector openings and closings, market events, annual collective vacation for business / manufacturing sector	Regular and special religious and social events, including weddings, births, and community festivals	Opening and closing of key infrastructure, key construction	Publishing dates or deadlines, information campaigns, special events / launches	Events linked to the natural or manmade environment	Dates and time for events, relevance to the calendar



Step 3: Damage and Casualty Analysis / Risk Assessment

Casualty Threshold ²	Risk Level Categories (A, B, C, D, and E) (Collateral Damage and Casualty Estimate)	Risk Level	Assessed Risk Level	Mitigations	Residual Risk Level (assessed risk level - mitigations = residual risk level)	Residual Risk Level to Approval Requirement/ Targeting Engagement Authority ³	
Theatre specific.	Level A. Reasonably certain that the activity will directly or indirectly result in: 1. A significant ⁴ number of civilian deaths (i.e., > than the CT); and / or, 2. <i>Catastrophic damage</i> ⁵ to significant facilities, structures or critical infrastructure causing <i>prolonged undue hardship</i> ⁶ for the local population (i.e., schools, religious sites, hospitals, power grid).	A. Very High / Extreme	Identify the appropriate risk level (e.g., A- Very High / Extreme).	Describe activities to mitigate or minimize collateral damage and casualties.	When mitigations are considered, what is the residual risk level? 1. Very High / Extreme 2. High 3. Medium / Moderate 4. Low 5. Very Low	1. Approval of higher Commander is required 2. Approval of higher Commander is required 3. Activity approved by Commander 4. Activity approved by Commander 5. Activity approved by Commander	
	Level B. Reasonably certain the activity will directly or indirectly result in: 3. A limited ⁷ number of civilian deaths (i.e., = / < the CT); and / or, 4. <i>Severe or extensive damage</i> ⁸ to significant facilities, structures or critical infrastructure causing <i>undue hardship</i> for the local population	B. High					
	Level C. Reasonably certain the activity will directly or indirectly result in: 5. Limited harm or injury to civilians (but civilian deaths are unlikely); and / or, 6. <i>Moderate damage</i> ⁹ to significant facilities, structures or critical infrastructure causing <i>limited hardship</i> for the local population.	C. Medium / Moderate					
	Level D. Reasonably certain the activity will directly or indirectly result in: 7. Limited harm or injury to civilians (but civilian deaths are highly unlikely); and / or, 8. <i>Limited or minor damage</i> ¹⁰ to significant facilities, structures or critical infrastructure causing <i>minor hardship</i> for the local population	D. Low					
	Level E. Reasonably certain the activity will directly or indirectly result in: 9. No harm or injury to civilians; and / or, 10. <i>No or superficial damage</i> to significant facilities, structures or critical infrastructure that may cause <i>slight or limited minor hardship</i> for the local population.	E. Very Low					



¹ Based on the Target Systems Analysis (TSA) and Target Audience Analysis (TAA) and aligned with the PMESSI+PT / ASCOPE crosswalk, this is the analyst's description of the potential impact of the activity. This is a brief account of what may happen (i.e., outputs), including intended and unintended as well as positive and negative. It should be noted that the list of sub-factors are suggestions and is NOT meant to be exhaustive. Additional sub-factors and descriptions should be included, based on the area of operations. While PMESSI / ASCOPE crosswalk is the original framework developed to appreciate the various factors of the operational environment, lessons-learned from counter-insurgency and stability operations identified a number of knowledge, namely physical environment (P) and time (T). The PMESSI+PT / ASCOPE crosswalk is argued to be a more robust and holistic framework for characterising the operational environment (see: US Army Centre for Army Lessons Learned, Assessments and Measures of Effectiveness in Stability Operations Handbook (U), Handbook 10-41, May 2010, Unclassified).

² Casualty Threshold (CT) is established by the Chief of Defence Staff (CDS) or delegate and is mission-specific.

³ Level of Target Engagement Authority (TEA) will be delegated by the CDS. The TEAs identified here are placeholders / examples only and should be updated for each operation.

⁴ A *significant number* is any X number of civilian deaths greater than ($>$) the CT. For example, if the CT is 10 civilian deaths, then a significant number may be 11 (or more) civilian deaths as a result of action. The CT and the qualifying value for 'limited' and 'significant' civilian deaths will be determined by the CDS and published in the operational-specific Targeting Directive (TD). In other words, the CT and values for are not static / set numbers and will be identified by the CDS for each operation.

⁵ Catastrophic damage can be defined as a level of damage which renders the building completely unusable, requiring demolition and building of a new structure.

⁶ The notion of hardship in the NKTRAM is context specific. For example, a population in a developed country may regard the loss of electrical power for 72 hours as 'prolonged undue hardship', whereas a population living in an area with historically limited access to electricity may consider the loss of power as a 'minor inconvenience'. A working definition of a hardship scale will need to be developed for each mission, and likely adjusted over time as the conditions of the operating environment change.

⁷ A *limited number* is any amount equal to or less than ($= / <$) the CT.

⁸ Severe or extensive damage can be defined as a level of damage which renders the building unusable, requiring major reconstruction.

⁹ Moderate damage can be defined as a level of damage which renders a building or a portion thereof unusable for a short period of time (days or weeks), requiring significant repair.

¹⁰ Limited or minor damage can be defined as a level of destruction which permits reduced use or occupancy for a short period of time (hours or days), requiring minor repair.