

# Modelling Non-Combatants in Research Wargaming – The Way Ahead

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## **ABSTRACT**

*Research wargaming (RW) within DRDC CORA does not currently include Non-Combatants (NC) as participants in any realistic way. It has been suggested that the absence of NC in some wargames, especially those involving combat in urban zones, may create artificial results and may lead to different conclusions than might otherwise have been obtained.*

*The aim of this note is to highlight several pressing research areas to be examined before including NC in RW. This note is intended to serve as a launch pad for further research. It does not attempt to provide answers to the problem of modelling NC within RW.*

*The note identifies four topic areas for further research with specific questions for each one. The four are:*

- *RED Behaviours in the Presence of Non-Combatants;*
- *Non-Combatant Behaviours*
- *Technical Aspects of Modelling Non-Combatants.; and*
- *Usage of Modelling Non-Combatants in Research Wargames*

*The note makes recommendations and describes the way ahead.*

## **1.0 INTRODUCTION**

### **1.1 Background**

The Land Forces Operational Research Team (LFORT) conducts research wargames for the purpose of supporting a number and variety of Canadian Forces (CF) initiatives. Sponsors and researchers alike have an abiding interest in the possible effects on the outcomes of these studies if civilians (non-combatants or NC) are incorporated into the games.

Research wargaming (RW) within DRDC CORA does not currently include NC as participants in any realistic way. It has been suggested that the absence of NC in some wargames, especially those involving combat in urban zones, may create artificial results and may lead to different conclusions than might otherwise have been obtained.

Civilian Activity Modelling for Exercises and Experimentation (CAMX) [1] has been developed by the DRDC CORA Land Capability Development Operational Research Team (LCDORT) to consistently and

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efficiently model NC behaviour in combat zones and has been used within training exercises to provide more realism to the trainees. CAMX is also intended to be used to model NC behaviour in RW. However, the effort required to model NC does not stop at the actual manipulation of the NC entities within the game. NC behaviours and roles must be defined, locations and densities must be set and finally their contribution to game outcomes must be analysed and reported. There is a potential for the inclusion of NC in RW to create as much or more artificiality in the result if it is not informed by objective research into NC behaviour and RED behaviour in the presence of NC.

The difference between the Training and RW requirements for combat models is subtle yet profound. All aspects of combat modelling for training must be useful in contributing toward the training objectives to be achieved through the model. To the extent that inputs contribute to the objective, whether or not they are commonly observed in theatre is of lesser importance. Training can have many different objectives including the creation of an adaptable and mentally agile force that can react positively to unexpected events and activities. This would be difficult to achieve in a highly complex and ever changing environment if the inputs to a combat model were always the same or exclusively based on present and past common experience. Training with combat models is supplemented with live training and classroom learning to produce the desired condition of the soldier. On the other hand RW must consider whether or not the modelled behaviour confers an unrealistic advantage to one option or another and whether or not additional inputs add more or less clarity to the study. If the modelled NC behaviours are even suspected to have influenced the findings of the study the selection of one set of behaviours over another could be contentious and must be defensible. Of note, the findings of RW are also supplemented by other factors such as costs, logistics, collateral damage risk and other considerations. Thus training and RW combat modelling, while different, are both contributors to larger processes, not definitive arbiters of final outcomes and decisions. These larger processes provide many opportunities to inject a proper examination of the factors that some would argue need to be tested through more realistic combat modelling. Some would say that the more realistic the combat modelling, the less effort and expense required at later stages in the process. Until the cost of creating more realism is known, whether or not it is recovered by savings later on is a question that cannot be answered.

### 1.2 Aim

The aim of this note is to highlight several pressing research areas to be examined before including NC in RW.

### 1.3 Objectives

The objectives of this report are to:

- Identify key information gaps about the behaviour of NC within combat zones;
- Identify key information gaps about the behaviour of RED forces in the vicinity of NC;
- Identify NC modelling challenges within RW;
- Identify gaming and analysis challenges arising from the presence of NC within RW; and
- To outline the research required to fill in the information gaps and develop methods to meet the challenges presented by modelling NC within RW.

### 1.4 Scope

This report is intended to serve as a launch pad for further research. As such it will illuminate the issues raised by including NC in RW. It does not attempt to provide answers to the problem of modelling NC within RW.

## **2.0 NON-COMBATANTS IN RESEARCH WARGAMING**

### **2.1 Issues**

The inclusion of NC within RW is thought to be capable of fulfilling at least two objectives. The first would be to provide “live clutter”, making the task of detecting opponents more difficult. The second would be to provide a study environment in which the potential for NC casualties may be estimated when comparing two or more options.

Without NC presence in the game, both sides are free to devote as many sensors as can be brought to bear on an area of interest or a detected entity to facilitate the identification and engagement of a suitable target. The first objective appears relatively easy to achieve, particularly with models such as CAMX to govern the behaviour of the NC. This appearance is deceptive for a number of reasons that will be discussed in this paper.

Weapons, tactics, sensors, force structures and more may be studied using RW. Each option may or may not be thought to affect the number of NC casualties however there is no current method to test this idea. The second objective demands that the behaviours of the NC be modelled according to objective guidelines based on a rigorous understanding of how NC behave in combat zones. Option ranks that are derived even in part from their effects on NC will be the subject of much debate unless the modelled NC behaviours are known to be both realistic and likely to be encountered in real conflicts.

For this discussion, western military forces are described as BLUE while those opposed to them are described as RED. Regular RED forces are more disciplined and more likely to conform to international laws regarding NC. It is the irregular RED forces in asymmetrical conflicts that raise the most concerns about NC casualties. For example in addition to fighting amongst the people without actually targeting them, the Anti Government Elements (AGE) in Afghanistan have purposefully killed NC who were believed to cooperate with the Afghan Government and indiscriminately killed NC to terrorize the population in order to reduce active support to the Government [3]. Anecdotal evidence from the recent history of armed asymmetrical combat indicates that irregular RED forces are willing to risk NC lives to provide cover for RED forces or even sacrifice NC in the belief that a high body count will promote their cause or cause BLUE to cease the fight. This can be seen in the practices of wearing NC clothing during operations, setting up operations and bases in close proximity to groups of NC, actively providing false information to encourage BLUE to mistakenly target NC, coercing NC into participating in RED operations and even slaughtering NC themselves then attempting to lay responsibility on BLUE.

### **2.2 Non-Combatant Behaviours**

The United Nations Human Rights Council has reported that there were about 1500 Afghan NC casualties in 2007 [3]. Well over half of them were killed by AGE but the international and national security forces were responsible for most of the remainder, while others died at the hands of unknown or unorganized groups or individuals. The number of NC casualties in that combat zone is so high in relation to combatant casualties that there are calls for attention to them in RW. At the tactical level NC represent “living clutter” in a combat environment. This causes uncertainty and delay for BLUE attempting to identify and engage RED. They also present a strategic challenge in the sense that any NC who are killed may cause support for the mission to fail and NC proven to have been killed by BLUE may result in charges of war crimes.

Modelling NC within RW is a complex and challenging area of study. Of the few available studies about NC in combat zones none provide quantitative analysis of the behaviour of NC [4, 5, 6, 7]. The available incomplete qualitative discussions of NC behaviour are an insufficient basis on which to build a research wargame. Moreover NC in a research context also includes civilian-pattern vehicles, which are not

discussed at all in the studies but have the potential to affect the impact of NC personnel in combat zones. These studies, plus anecdotal observations, have found NC to engage in a wide range of simple behaviours as listed in Table 1. Note that the list is in all probability incomplete, but does represent a sufficient range to illustrate the issues to be examined. These behaviours each carry their own potential effect on the survival of the NC, the behaviour of combatants in the presence of NC, the outcome of the operation and ultimately the success or failure of the campaign. They are referred to here as simple behaviours because they include only one action. Complex behaviours include multiple simple actions either simultaneously or coordinated over time to accomplish an intended purpose.

**Table 1: (Incomplete) List of Non-Combatant Simple Behaviours.**

Behaviour	Remark
Hide	Keep under cover where they believe they are safe.
Escape	Quickly leave a combat zone. This includes running towards RED or BLUE (For example, some NC do not know where the forces are and flee towards them; or they believe siding with one of the forces is safe) or running into an unoccupied area.
Ignore	Continuing their routine activities within the combat zone.
Approach	Move towards a combat zone or violent event for any reason.
Involuntary Human Shield	NC who are used by RED as shields during an attack. It also refers to the NC who are involuntarily or unknowingly in or around RED’s military targets to deter BLUE from attacking those targets.
Voluntary Human Shield	NC who voluntarily use their bodies or vehicles to shield RED during an attack. It also refers to the NC who are voluntarily in or around RED’s military targets to deter BLUE from attacking those targets.
Congregate	Act of gathering around BLUE without physically attacking the forces. The intention could be friendly or hostile. It could evolve into swarm behaviour if hostility increases, or escape if BLUE starts firing.
Loot	Indiscriminately and openly taking of goods by force with or without the presence of BLUE. Goods could include BLUE assets.
Swarm	A crowd of “NC” attacks BLUE at a single time and place.
Attack	Individual “NC” attack BLUE at random times and places.
Communicate	Passing information via wireless and landline telephone in a combat zone. This behaviour probably has no immediate consequence to BLUE but it could affect how an event evolves. To whom they communicate is also relevant and may vary.

Although the probability of being killed is likely to vary, most behaviour listed in Table 1 could cause NC to become innocent victims of war. Likewise the various behaviours generate different levels of living clutter. Both of these effects from NC behaviour have the potential to affect the ranking of the studied options.

**2.3 Irregular RED Force Behaviours**

The incomplete list of radical, irregular-RED behaviours provided in section 2.1 serves to highlight another aspect of modelling NC in RW. That is – what can be expected of RED in the presence of NC? Any RW including NC would have some restrictions imposed on BLUE; otherwise their presence in the

game serves no purpose. Whatever interaction occurs between RED and NC is also certain to have some impact on the outcome of the study. Thus two sets of behaviours must be modelled, neither of which have substantial research to support them. The complete range of behaviours for both NC and RED in the presence of NC has yet to be identified. After that is accomplished the probability of a particular behaviour emerging in a particular situation needs to be quantified. Table 2 provides a simple matrix of RED-NC interaction based on three notional assumed behaviours for RED and two (Escape and Hide from Table 1) for NC. These overly simplified homogeneous descriptions and potential outcomes serve to illuminate the need to use appropriate and justifiable behaviours. A reader may wish to elaborate or even argue the outcomes in this table. That in itself is an indication of the requirement to conduct further research in order to get it right.

**Table 2: RED and NC Behaviour / Outcome Matrix.**

RED \ NC		NC Reaction to RED's Killing	
		Escape	Hide
RED Objective For NC	<b>Avoid Casualties</b>	Very few if any NC casualties. NC provide minimal screening for RED as the situation develops, none after shooting	Very few if any NC casualties. NC provide minimal screening for RED as the situation develops, none after shooting starts.
	<b>Indifferent to Casualties</b>	More NC casualties than above as both RED and BLUE engage a few unlucky or slow NC.	NC who take shelter in or near what turn out to be good (and occupied) firing positions become collateral damage when those positions are engaged by the opposing force..
	<b>Maximize Casualties</b>	Large number of NC casualties as RED runs with the crowd and or engages them from cover.	RED is more mobile than usual as they seek out NC to engage. Possibly fewer NC casualties than if they ran away unless many NC are concentrated in a few shelters.

Note that the NC-Reaction-HIDE / RED-Objective-Indifferent cell indicates that both BLUE and RED may unintentionally cause NC casualties while firing upon their opponent's active firing positions.

The above discussion only focuses on the relationship between RED and NC. The behaviour of BLUE towards NC is bounded by laws and codes. Moreover, an individual BLUE's behaviour towards NC is unlikely to vary much because they are professionally trained soldiers. Thus it is relatively easy to comprehend and model BLUE's behaviour towards NC in RW. Nevertheless, modelling and maintaining consistency of the BLUE-NC behaviour is not trivial. The attitude of NC towards the BLUE can vary from supportive to hostile and the attitude of the group is unlikely to be homogeneous. To make the situation even more complicated, NC are not necessarily unarmed even though they are genuine civilians. The scope of behavioural modelling can extend to NC-to-NC relationships, of which looting is an example. (An individual NC may be more likely to loot if other NC in the area are looting.) Another example is that competing factions of NC misinform the BLUE force to cause them to purposefully target rival NC.

**2.4 RED BLUE and NC Situational Awareness**

While RED's behaviour toward NC could reasonably be assumed to be consistent among the individual RED combatants (at least at the outset of the conflict) the same cannot be assumed for NC. This adds another level of decision when modelling NC behaviour. What proportion of the NC present in the game will engage in behaviour B under circumstance C? What happens when circumstances change? Do NC realize that circumstances have changed (i.e., has the shooting stopped temporarily or permanently? What

new weapons have entered / exited the fight? Has RED decided to target NC in a last desperate tactic?) How quickly do NC realize that circumstances have changed? How quickly is information passed through a number of NC? Note that NC modelled with the same level of situational awareness (SA) as the combatants would exaggerate current concerns about the near perfect SA available within RW to both RED and BLUE. Real NC are likely to possess substantially worse SA than real combatants. They have no formal command structure and no formal communications links though the latter may be overcome by use of cell phones. They may have a better understanding of local geography and perhaps a better grasp of RED capabilities, positions and intentions than BLUE possesses but even this will vary between individuals. The question remains as to how different is their SA and can it be accurately modelled?

So far the discussion has focused on NC casualties as an outcome of their presence in RW. It has been suggested that, given the current level of understanding, NC should be included only to obscure RED and create a targeting challenge for BLUE in that not every detection can be assumed to be RED. Presumably RED would experience the same challenge while identifying BLUE. Note that under any rules of engagement other than RED deliberately using NC for cover and remaining among them after shooting starts (combined with NC not exiting the combat zone), any such clutter effect derived from modelling NC would be minimal.

Injecting collateral damage into the wargaming environment would cause both forces to work harder, perhaps take more time identifying targets before engaging and to exercise more caution with high explosive weapons. Consequently, if BLUE must avoid or minimize NC casualties and the RED force is exempt from NC casualty constraints RED is provided with slightly more flexibility as they have more time and 'cover' to act out their role. However, if the RED interactors suspect that BLUE is constrained they can easily arrange for NC casualties to occur and thus artificially end the game on their terms. Restrictions might also be placed on RED, but these would become a specific NC objective for RED that could not be changed in the course of the game and would be meaningless unless RED was always assumed to be avoiding NC casualties.

In most RW systems RED, BLUE and possibly NC entities are either correctly observed (though some details may be unavailable) or not observed at all. The appropriate level of SA must be created among combatants that will allow NC to be incorrectly identified as RED, NC as BLUE, BLUE as NC or RED as NC. This is an important consideration, for if no misidentification is possible, NC are of limited value for any purpose in RW. Likewise if too much misidentification occurs, the games will degrade into a series of simulated war crimes, or BLUE withdrawals.

In order to provide continuous clutter throughout the game or to model an expected situation, NC movement patterns may need to be complex or persistently intermingled with RED even after the shooting starts, whether or not RED is employing human shields. The above noted rules may keep the level of NC casualties within the intended limits of the study but unintended casualties do occur in RW. Fratricide from grenades, collisions with vehicles, personnel transiting suppressive fire zones, occupants of collapsing buildings and unseen personnel who fall victim to high explosives are just a few examples of currently possible unintentional deaths. NC would be as susceptible to these as the soldiers are. Separating these unintentional deaths from deliberate or mistaken direct engagements, thus ensuring appropriate due diligence was exercised over several or even dozens of games, could easily become very onerous and expensive.

### 2.5 Due Diligence

Every real BLUE commander knows that deliberately targeting NC is a war crime with severe consequences; they also know that they have the right and the duty to protect their soldiers even if that means NC become collateral damage. In real combat situations decisions involving NC are extremely difficult to make and are subject to intense scrutiny afterward, if casualties are involved, in order to

ascertain whether the proper decision was taken. Would it be easier to make the decision to sacrifice virtual NC? What consequences would such a decision provoke?

Ensuring that the interactors follow their rules of engagement also means that the RED interactor is required to pursue the RED objective to the best of their ability. If that objective includes anything to do with NC other than minimize NC casualties, the RED commander is obliged to kill or arrange for BLUE to kill as many as are required to accomplish the RED objective. Proper RW requires RED to exploit any advantage over BLUE.

The task of ensuring that interactors follow their rules of engagement already requires both a high level of trust in the interactors and attention to the details of the modelled action. The possibility exists that a controversial conclusion based on a study that included civilians could be challenged based on NC deaths (unintentional or not as described in section 2.4), researchers could be required to expend additional effort at a very fine level of detail to ensure that a consistent and appropriate level of due diligence was applied in every game. The circumstances of every NC death may have to be examined and the interactor's intentions identified. Researchers would be tasked with answering the question of what to do if due diligence was not followed? Replay the games? Include cautions in the report? If NC are included in RW, does it follow that an element of virtual "legal oversight" or "after-action enquiry" be included in the study as well? While this example may seem extreme, the conclusions of RW studies often spark vigorous debate and there is no reason to believe that NC behaviours will not be the subject of one.

### 2.6 Modelling Tactics, Techniques and Procedures

Current CF practice recognizes that NC may be present in any combat situation. CF commanders operate under rules of engagement that are intended to minimize NC casualties while still permitting a high probability of success with acceptable levels of risk to CF soldiers. The details of these rules are classified "secret – need to know" in order to minimize the risk that opponents will become aware of them and develop more effective counter-tactics.

Current efforts to model the restrictions imposed on CF soldiers without actually modelling NC within the game include the following:

- BLUE cannot engage a target unless it has been identified by side (RED), nature (vehicle or person) and type (type of vehicle, rifleman, grenadier, etc.)
- BLUE cannot engage a room or building with high explosive weapons unless an identified RED target has been observed there.
- All current RW excludes the possibility of calling in close air support (CAS) or long-range, large-calibre artillery. This is primarily for the purpose of testing the weapon options under study but also has the effect of assuming that NC are present in the area as these two combat elements are the major sources of NC casualties from BLUE action.

Note that these restrictions are imposed on BLUE exclusively. Properly followed they achieve the objectives of obscuring RED, forcing BLUE to work harder to target RED and restricting the use of high explosives. In any case, the additional effort required to realistically model NC within RW will be expected to produce at least a commensurate improvement in the fidelity of wargame results and an increased level of real confidence in them.

### 2.7 Which Studies May Be Affected?

What nature of RW study will or will not be more realistic when NC are included is a topic for further research. The nature of area suppression high explosive (HE) weapons would seem to lead to the

conclusion that they could be severely restricted compared to direct fire ballistic weapons in the presence of NC. Direct fire ballistic weapons, particularly machine guns, are often used within RW to lay down suppressive fire on RED positions or likely routes of manoeuvre. While in real combat this would cease at the moment a BLUE gunner observed NC entering or passing in front of the beaten zone, in current wargames this is only possible during the interactive game and then only if the interactor notices the NC movement in time to stop the shooting. An interactor may have as many as 32 soldiers to command while attempting to keep track of the opposing force. Constantly watching an individual BLUE gunner, his line of fire and his beaten zone is an additional and very demanding task. Thus it can be seen that RW including suppressive fire and HE would be most likely to record collateral damage.

In any RW that includes NC the BLUE force will perhaps be torn between avoiding NC casualties and successfully completing the mission. A RED commander tasked with driving up NC casualties will proceed with killing them no matter what BLUE does, while one who is indifferent may use the suspicion that BLUE is attempting to avoid NC casualties to further his objectives. A RED commander trying to minimize NC casualties will face the same dilemma as the BLUE commander, perhaps producing a series of stalemates. A series of games in which either commander effectively called off the mission in order to avoid NC casualties will produce results of limited use to the objective of comparing one system vs. another, unless one criteria of the study is the potential for NC casualties. (Note that this is a much more demanding objective of modelling NC than generating “living clutter”) Games that are prolonged or have to be replayed for the same reason will also drive up the cost of conducting the study.

It is important to restate here that the purpose of RW is to compare and contrast different options for the purpose of ranking them to inform a decision about which to choose. It is important that this input be both high quality and timely. The inclusion of NC in RW will improve the quality if done properly for the appropriate studies however it is incumbent on the researchers to ensure that timeliness is not impaired and that NC are included only in those studies which will clearly benefit from their presence.

### 2.8 Other Considerations and Summary

The prospect of including NC in RW also raises the following questions: What granularity of detail is necessary to describe civilian behaviour in a given wargame and over what time frame? When are complex rules of behaviour that take into account NC intentions (“stay alive but support RED if possible”) required and when might simple reactionary (“if shooting starts then run”) responses suffice? The concise question is how detailed does the NC modelling have to be in order to create realistic input to the RW?

All of the above is presented for the purpose of outlining the challenges to overcome and listing the necessary research in order to realistically model NC for informative RW. To proceed with modelling NC in RW without answering these important questions is to run the risk of creating naively “more realistic” results that will be, at least, just as artificial as those obtained in studies without NC. NC inclusive studies will be more expensive and researchers or readers may think that they are more realistic. Note that any scrutinized aspect of a wargame will fail at some level. The question then is what level of NC representation is sufficient to meet the objectives of the RW study? Not: what level can be attained?

### 3.0 TOPICS FOR FURTHER RESEARCH

The modelling of NC within RW is a practice to be adopted only after due consideration of the following issues. Further research is necessary in order to create appropriate, realistic input to the model. To proceed without this information would be to create a naively more realistic RW environment with problems that would lie in wait to create future difficulties for future practitioners. These future research topics can be divided into four areas; RED, NC, Technical and Usage aspects of modelling NC.

### **3.1 RED Behaviour in the Presence of Non-Combatants**

- How does RED behave in the presence of NC?
- How does RED's behaviour toward NC change as the battle progresses and they begin to lose or win?
- Is variation in individual RED soldier behaviour toward NC to be expected and if so to what extent?
- How much additional effort is required to ensure that RED consistently behaves as intended toward NC?

### **3.2 Non-Combatant Behaviours**

- What NC behaviours have been observed in combat?
- How does this behaviour vary from one theatre to another?
- What proportion of NC will engage in any one behaviour?
- How does the proportion change as circumstances change?
- How much worse (or better) is NC SA?
- To what extent and how quickly do NC realize that circumstances have changed?

### **3.3 Technical Aspects of Modelling NC**

- How to model the appropriate level of SA among combatants that will allow NC to be incorrectly identified as RED, NC as BLUE, BLUE as NC or RED as NC?
- Does the presence of NC require more games to be played (perhaps with different NC behaviours) in order to explore a wider range of possible outcomes?
- What granularity of detail is necessary to describe civilian behaviour in a given wargame and over what time frame?
- When are complex rules of behaviour that take into account NC intentions required and when might simple reactionary responses suffice?

### **3.4 Use of Modelling NC in Research Wargaming**

- Given the purpose of RW, to what extent is the presence and behaviour of NC in RW likely to change the outcomes and conclusions of studies?
- What nature of RW is likely to be affected by the presence and behaviour of NC within the study?
- How do researchers ensure that a consistent and appropriate level of due diligence with regard to NC casualties is applied in every interactive game?
- What if due diligence is not applied consistently?
- What value can aborted missions (due to high likelihood of NC casualties) contribute to weapon system comparison studies?

## **4.0 RECOMMENDATION AND WAY AHEAD**

The topic of modelling NC behaviour is far too large and complex to be studied in one project. The plan is to proceed in manageable stages that will produce outcomes to be included in RW as and when doing so can be demonstrated to be a positive change that is worth the additional effort required.

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