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Moving beyond attrition in modelling land combat

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Abstract: The force design that a military adopts substantially influences force employment options for the initial operation and ongoing conflict. The ability to assess force design to determine what it means for the operation is an important capability; understanding the implications and trade-offs that selected force design have on combat effectiveness provides an advantage. Numerous attrition-based effects models evaluate force design, but typically do not examine cross-domain feedbacks or the doctrine-stated objective of defeating Opposing Force (OPFOR) will to fight.

We developed a medium fidelity system dynamics (SD) model that includes attrition-based effects as well as the dynamics of cross-domain feedback-based effects and will to fight over time. The model has been designed to incorporate rapid extensions to the existing baseline model to evaluate emerging combat technologies. The baseline SD model is in the final stages of case vignette validation. The overarching objective is to use the model to evaluate the impact future technologies will have on force design and force structure, and consequently combat effectiveness. For this purpose, we model modern warfare as consisting of six primary sectors required to represent kinetic and non-kinetic effects: Direct Fires, Combat Service Support (CSS), Battlefield Control, Cyber Electro-Magnetic Activities (CEMA) and Situation Awareness, Indirect Fires and Will to Fight.

Here we present the Direct Fires sector and the CSS sector in detail. The Direct Fires sector represents kinetic effects, inclusive of targeting strategies, target acquisition and target firing. To represent modern combat, the force consists of mechanised, motorised, and dismounted infantry components. Fires and repair capability affect the attrition rates of force components. In addition to fires, attrition rates are modified by the feedback effects from non-kinetic effects such as battlefield control, situation awareness, and will to fight. Fires also depend on CSS, which represent supplies necessary to continue fighting. The CSS sector is represented as a multi-stage sustainment of the Force. Sustainment efforts can be targeted by OPFOR, which allows for interdiction effects across different stages of the supply chain.

The model can be used to address "what-if" questions related to force design assessments, such as: What happens if one Force is more lethal and one Force is larger and both are supplied adequately, which Force has the most combat effectiveness? What happens if the more lethal Force is undersupplied? How does undersupply effect the more lethal Force's combat effectiveness? Preliminary results show that, all conditions being equal, if Red Force is cut off from resupply, then halfway through the battle Red Force has lost approximately twice as much as Blue Force. If Red Force is twice as lethal as Blue Force and is cut off from resupply, then at the halfway mark, Red Force has lost half of Blue Force results.

Preliminary insights from simulation analysis of the model exploring these different force structures show promise for examining the effects of future technologies on combat functions. In summary, the model provides an accessible tool to examine assumptions in a rapid way.

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