

# Unit Combat Power (and Beyond)



**Briefing for ISMOR**

**28-31 August 2007**

# Purpose and Agenda

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- **Purpose.** To propose a revised method for:
  - **Assessing unit combat power and capabilities, and**
  - **Informing adjudication of outcomes and decision-making in modern combat simulations and war games.**
- **Agenda**
  - **Definitions.**
  - **Background.**
  - **Applications.**
  - **Problem.**
  - **Research approach.**
  - **Constraints, limitations, and assumptions.**
  - **Literature review**
  - **Consideration of options.**
  - **Recommended method.**
  - **Summary.**

# Definitions (1 of 2)

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- **“Combat power – The total means of destructive and/or disruptive force which a military unit/formation can apply against the opponent at a given time.”** (*Joint Pub 1-02, Department of Defense Dictionary of Military and Associated Terms, 9 June 2004*).
- **“Joint Functions” – The functions include:**
  - **Command and Control,**
  - **Intelligence,**
  - **Fires,**
  - **Movement and Maneuver,**
  - **Protection, and**
  - **Sustainment.**

(*Joint Pub 3-0, Joint Operations, 17 September 2006*)
- **“Elements of Combat Power” – The elements of combat power are the joint functions tied together by leadership.**
- **“Firepower score” – In models and wargames, typically a measure of the single round lethality of a particular weapon system. In some models, it is a product of lethality and rate of fire.**

## Definitions (2 of 2)

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- **“Combat Power Value (CPV)”** – In simulations and war games, the value assigned to a weapon system that measures (or estimates) its contribution to combat power relative to other weapon systems. This value may be a whole number or it may be normalized to a specified weapon system.
- **“Unit Combat Power (UCP)”** – In models and war games, the summation of the combat power values of the weapons systems available to the unit. For example, using normalized CPVs:  
*A combat unit contains 10 systems each with a CPV of 1.0 and 5 systems each with a CPV of 0.4. Thus, Unit combat power =  $10 \times 1.0 + 5 \times 0.4 = 12.0$*
- **“Unit readiness”** - The ability of a unit to accomplish the wartime missions for which the unit is organized or designed. In the U.S. military, this is measured as a “C” level that measures personnel, equipment on hand, equipment readiness, and training level.  
*(AR 220-1, Unit Status Reporting, 19 December 2006).*
- **“Strength Value”** – Term to designate the unit strength or unit combat power for new or revised methods evaluated in this research.

# Background

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- **Theories of combat and combat outcomes typically include some estimate of relative combat power or force ratio. These include:**
  - **Scientific theories of combat proposed by Clausewitz, Jomini, Bloch, Fuller, and others.**
  - **Fiske – 1905.**
  - **Lanchester – 1914, and Osipov – 1915.**
- **Relatively recent efforts include:**
  - **Soviet Union correlation of forces and means (COFM).**
  - **U.S. weapons effectiveness indices/weighted unit values (WEI/WUV). *WEI/WUV out of favor in U.S. Army.***
- **Theories and variations of unit combat power are applied in a number of useful war games and simulations to:**
  - **Train commanders and staffs,**
  - **Inform course of action planning, or**
  - **Inform force development and systems acquisition decisions.**

# Operations and War Games Applications

## *Examples*

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- **Operations.** In Desert Storm, Gen Schwartzkopf wanted airpower to reduce the enemy to a specified strength before committing ground forces.
- **War games.**
  - Force ratios and strength of units used by human-in-the-loop war gamer for decisions regarding maneuver, fires, resupply, etc.
  - Residual unit combat power used to assess outcomes (How well did the force survive?).
  - Force ratio (unit combat power comparison) used in some war games or aggregated force-on-force models to adjudicate victory or defeat in an engagement.

# Combat Simulation Applications

## *Examples*

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- **Closed-form simulation heuristics (decision rules).**

- **Decision based on remaining percent of initial unit strength:**

- **Discontinue attack if strength less than 60%.**

- **Merge unit with another when strength falls below 30%.**

$$\text{Percent Strength} = \frac{\sum (\text{current \# systems}_i * \text{system value}_i)}{\sum (\text{initial \# systems}_i * \text{system value}_i)}$$

- **Decision based on force ratio:**

- **Use joint effects to achieve a force ratio of at least 3:1 before attacking.**

$$\text{Force Ratio} = \frac{\sum (\text{friendly \# systems}_i * \text{system value}_i)}{\sum (\text{enemy \# systems}_j * \text{system value}_j)}$$

Where:

*i* is the *i*th system of *n* systems in the unit,

system value = combat power value (or firepower score).

# The Success Story

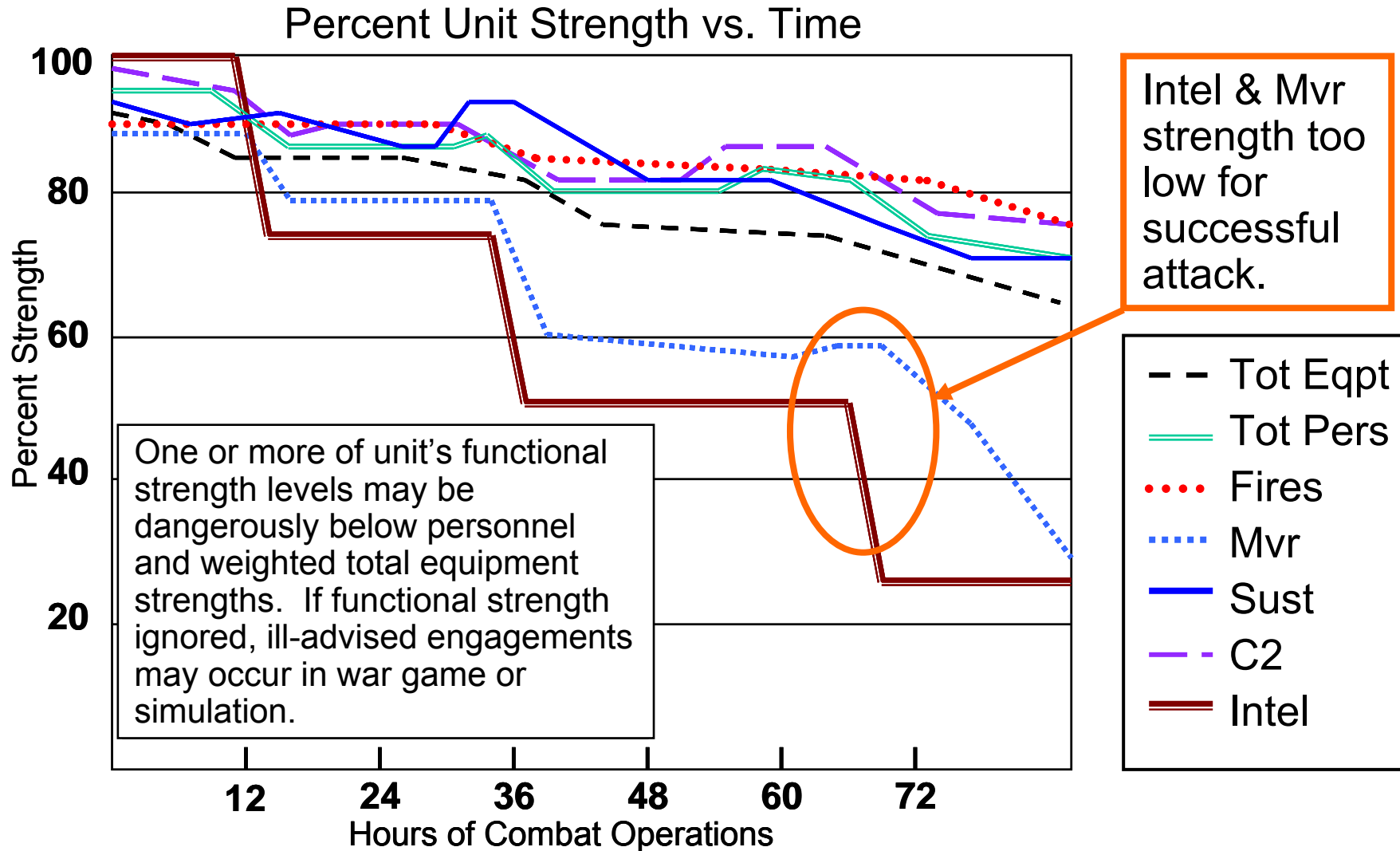
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- **Analysis that used combat power values and unit combat power assessments successfully informed decisions regarding concepts, organizations, and equipment needed to win on a traditional battlefield.**
  - **Concepts:**
    - Airland Battle.
    - Deep attack and “Deep Fires”.
    - Multiple, simultaneous engagements using combined arms.
  - **Organizations:**
    - Division Restructure.
    - Force XXI.
    - Modular Force.
  - **Equipment:**
    - Army “Big Five”.
    - Deep attack rockets and missiles (Multiple Launch Rocket System and Army Tactical Missile System).
    - Stryker Combat Vehicles.



# The Challenge of Ignoring Functional Capability

*Example*



# Problem

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- **Problem:** With the challenges of irregular warfare, stability operations, and weapons of mass destruction, and the advent of new military systems that are multi-functional and network-enabled, what is an appropriate approach to determining unit strength value?

**Is unit combat power still the best way to examine capability to accomplish a given military mission?**

# Research Approach

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- **Conduct literature review to determine basis for, and strengths and limitations of, previous and current strength value methods.**
- **Modify methods or create new options that address or transcend limitations of previous methods.**
- **Compare advantages and disadvantages of the methods.**
- **Recommend a method.**

## **Goals:**

- **Reduce subjectivity of input data**
- **Help war gamer (or the simulation) make more realistic decisions.**

# Constraints and Limitations

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- **Constraints.**
  - **Values for unit strength and functional capability must :**
    - Be on a common scale for both friendly and enemy forces.
    - Be understood by the war fighter and war gamer and perceived as “reasonable and realistic”.
    - Account for differences in training or readiness (“regulars”, militias, home guard).
  - **Method must allow both “perceived” and “ground truth” assessments.**
  - **Method must account for more than just kinetic capability.**
- **Limitations.**
  - **Research did not address intangibles such as:**
    - Variances in human leadership, courage, and skills application.
    - Luck or divine intervention.
  - **Strength value is a static measure for a given situation, may not appropriately indicate a unit’s capability in a radically different situation (drastic changes in rules of engagement or disruptive technological breakthroughs).**
  - **Strength value may not be appropriate for use in aggregated force-on-force models that use a force ratio to determine victory or defeat.**

# Assumptions

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- **Assumptions.**
  - **Current and future war games and combat simulations will continue to use some strength value to inform gamer decisions, assist automated decision-making processes, and/or adjudicate outcomes.**
  - **Military systems/units can be properly associated with one or more specific joint functions.**

# Literature Review

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- **Variety of methods, each with strengths and limitations.**
  - **Strength based on percent remaining of “pacing items”.**
    - Supports good unit decisions, difficult to aggregate to higher units.
  - **Unit readiness based on Unit Status Report or Global Status of Resources and Training System (GSORTS) methodology.**
    - Measures troop strength and training, equipment availability and maintenance, but not effectiveness relative to opposing force.
  - **Red-Amber-Green**
    - Subjective evaluation but still based on some strength value.
  - **“School house” unclassified unit and system combat power weights.**
    - Adequate for teaching/training but not for combat development.
  - **COFM and WEI/WUV, and TASCFORM variations.**
    - Measure lethality, survivability, and mobility with subjective input.
    - Were appropriate for “Cold War” and “Arms Race” assessments.
  - **Anti-potential Potential and related formulations.**
    - Relies on assessment of system vs. system attrition rate but is very situation dependent.
- **Each method has some utility in “real world” to inform:**
  - **Force allocation and operational course of action decisions.**
  - **Force structure and acquisition decisions.**

# Options Proposed for Consideration

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- **Option 1 - Improve method for developing firepower scores and strength values.**
  - **Use dynamic calculation based on simulation results.**
  - and/or**
  - **Introduce additional factors for assessing functionally- specialized systems or multi-function systems.**
- **Option 2 – Use a new combination method.**
  - **Use a unit readiness approach, combined with**
  - **Joint function capability assessment with designation of “pacing” items. \***

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\* Pacing” items:

- Key to unit’s overall combat strength.
- Central to unit’s ability to perform its doctrinal mission.
- May vary as function of unit type.
- Typically no more than 4 “pacing” items for a unit.

# Consideration of Option 1

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- **Option 1 - Improve method for developing firepower scores and strength values.**

- **Dynamic calculation**

- **Pro:** Accounts for multiple factors and complexity of combat.
- **Con:**
  - Requires many simulation runs (time and resources),
  - Difficult to access run library for appropriate value, and
  - Emphasizes kinetic over non-kinetic effects.

**and/or**

- **Add factors for calculation for each joint function and recalculate a new score or value for each system.**

- **Pro:** Accounts for functional capability.
- **Con:**
  - Increased requirement for judgment regarding functional capability.
  - Difficulty of determining appropriate metric for comparable functional value across different systems supporting a function.



# Consideration of Option 2 (1 of 2)

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- **Option 2 – Combination method “Unit Readiness” component.**
  - **Pro:**
    - Used and understood by warfighters.
    - Accounts for personnel status.
    - Accounts for differences in training levels of friendly and threat “regulars”, militia, and insurgents.
    - Determines unit’s strength based on lowest value among personnel, equipment, or training.
    - Reduces subjectivity of system weighting and firepower scores.
  - **Con:**
    - Requires assessing unit training level (judged to be somewhat subjective).
    - Requires more comprehensive “decision rules”.
    - Does not directly measure unit effectiveness relative to opposing force.

# Consideration of Option 2 (2 of 2)

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- **Option 2 – Combination method “Joint function” component.**

- **Pro:**

- Army already uses “pacing” items in Unit Readiness.
    - Can be linked easily to Unit Readiness approach.
    - Can apply perception or ambiguity to strengths.
    - Outcome is a function of dependency of mission accomplishment on functional capability versus comparison of metrics.

- **Con:**

- Requires classification of system by contribution to joint function.
    - Requires designation of “pacing” item(s) for one or more joint functions.
    - Requires more thoughtful “decision rules” (leadership).

# Recommended Method

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- **New combined method – Unit readiness combined with assessment of joint functions using “pacing” items.**

- **Unit readiness accounts for:**

- Personnel strength as percent of authorized strength.
- System strength as percent of authorized system strength.
- System availability (accounts for maintenance and combat damage).
- Training level (accounts for differences in application of systems and unit tactics).
- The lowest value drives the overall unit strength.

- **Joint function assessment with “pacing” items enables:**

- Consideration of combat enablers,
- Application in areas of stability operations, irregular warfare, and weapons of mass destruction scenarios.

# The Proposed Formula

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## General formulation of new method for decision-making:

Given blue unit of type  $T_{Blue}$  in mission status  $M$  and environment  $S$ , decision whether or not to execute the  $k^{th}$  set of  $n_k$  actions  $A_k = \{a_1, \dots, a_{n_k}\}$ , where  $k \in [1, p]$  and where  $m$  red units are within a specified distance  $D$  from blue unit is based on criteria expressed as:

If  $Min\{P_{Blue}, E_{Blue}\} \geq X_1(T_{Blue}, a_1, \dots, a_{n_k})$  and  $w_i(T_{Blue}) \geq W_i(T_{Blue}, a_1, \dots, a_{n_k}), \forall i \in [1, 6]$  and  $Min\{P_{j Red}, E_{j Red}\} \leq X_{2j}(T_{j Red}), \forall j \in [1, \dots, m]$

Then execute actions  $A_k$ . Else if  $k \neq p$ , check decision criteria for  $A_{k+1}$ .

Where  $P$  = Percent personnel remaining,

$E$  = Percent equipment remaining,

$X_1$  = Threshold variable,

$w_i$  = Level of the  $i^{th}$  Function for blue unit type  $T_{Blue}$  based on count of pacing items,

$W_i$  = Threshold variable for the  $i^{th}$  Function,

$X_2$  = Threshold variable,

$T_{j Red}$  = Type of the  $j^{th}$  red unit.

# Summary

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- **New method reduces subjectivity of system weighting and firepower factors.**
- **It uses commonly understood Unit Readiness and “pacing” item techniques.**
- **Considers importance of joint functions.**
- **Enables improved representation of unit’s capabilities for stability operations, irregular warfare, and weapons of mass destruction situations.**
- **Moves toward fulfilling potential of new models and simulations that are communications-enabled, perception-driven, and commander-focused, such as Advanced Warfighting Simulation.**

**This method enables models, simulations and war games to more faithfully represent a commander’s multi-dimensional decision-making process.**

# Questions?

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