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Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39-18
OSD Perspective - Analytic Challenge: Global War on Terror Analysis

Preston Dunlap

75th MORS Symposium
June 2007
Irregular Warfare

“A violent struggle among state and non-state actors for *legitimacy* and *influence* over the relevant *populations*. IW favors *indirect* and asymmetric approaches, though it may employ the full range of military and other capabilities, in order to erode an adversary’s *power, influence, and will*.”

- Irregular Warfare Joint Operating Concept

- Counterinsurgency (COIN)
- Counterterrorism (CT)
- Stabilization, security, transition, and reconstruction operations (SSTRO)
- Unconventional warfare (UW)
- Foreign internal defense (FID)

- Strategic communications
- Psychological operations (PSYOP)
- Information operations (IO)
- Civil-military operations (CMO)
- Intelligence/counterintelligence activities
- Transnational law enforcement

Irregular Warfare analysis includes physical science but emphasizes social science phenomena
Framework for Irregular Warfare Analysis

DoD/Ally/Partner Actions
- Diplomatic
- Information
- Military
- Economic
- Financial
- Intelligence
- Law Enforcement

Existing tools insufficient to examine Irregular Warfare

Effects
- Political
- Military
- Economic
- Social
- Information
- Infrastructure
Approach to Irregular Warfare Analysis

No single tool sufficient to examine Irregular Warfare: Conduct Subject Matter Expert wargame informed by suite of tools

- Conduct subject matter expert wargame
  - Counterterrorism: GWOT X-Game
  - Counterinsurgency: Algernon commercial wargame derivative
  - Unconventional Warfare: Algernon
  - SSTR Operations: Peace Support Operations Model (PSOM)

- Informed by suite of analytic support tools (e.g., agent-based, game theory, system dynamics, expert systems)
  - System Dynamics: (M, E)
  - SEAS: (P, S, Info)
  - Generic rulesets derived from existing X-Game and COIN analyses (M: supplement models)

*Lists are not exhaustive

DoD/IA/Partner Actions
- Diplomatic
- Information
- Military
- Economic
- Financial
- Intelligence
- Law Enforcement

Wargame supported by suite of tools

Effects
- Political (P)
- Military (M)
- Economic (E)
- Social (S)
- Information (Info)
- Infrastructure (I)
Identify, assess, and prioritize capabilities used to prosecute the GWOT

• Help operationalize the GWOT CONPLAN and the regional GWOT plans
  – Identify types of WOT activities (location, frequency, duration)
  – Examine the relative contribution of activities to achieving WOT objectives
  – Identify resources needed to support activities (focus on Special Operations Forces - SOF)
  – Suggest activities where General Purpose Forces (GPF) might be fully/partially substituted for SOF

• Scope
  – Timeframe: 2007-2014
  – Multiple countries and terrorist groups
Application of GWOT X-Game to IW Analysis: GWOT Extended “X” Game Methodology

DIMEFIL Actions: Diplomatic, Information, Military (Direct and Indirect), Economic, Financial, Intelligence, Law Enforcement

PMESII Conditions: Political, Military, Economic, Social, Information, Infrastructure

GWOT Global Synch Conference

P, E, S, I
Fund for Peace
Failed State Index

M: SOCOM Military Capabilities Studies

Info: Pew Public Opinion Poll

Starting Conditions

US Military Direct/Indirect

Interagency

Allies/Partners

Red

Brown

Actions

Failed State Index Questionnaire

Conditional Rules

Generic Rules

SME Discussion

Adjudication Rules

Incident Tracker

Terrorist Tracker

PMESII Tracker

White Cell Adjudication

8 Years
15 terrorist groups
21 countries
**What is PSOM?**
- Peace Support Operations Model developed by the UK MOD/DSTL
- Multi-sided, time-stepped, tool-assisted “war” game incorporating human players representing coalition, indigenous, threat, and NGO elements
- Incorporates UK historical case study analysis
- Success measured by progress against level of consent (legitimacy), security, and stability

**How has PSOM been used?**
- Prototype used in joint/combined exercises
  - UK OIF wargame included allied participants (e.g., OSD/Policy SSTR, OSD/PA&E, Joint Staff participation)

**Application of PSOM to IW Analysis**

Support adjudication of Political, Military, Infrastructure effects
Application of System Dynamics to IW Analysis

• What is System Dynamics Modeling (SDM)?
  – Invented at MIT during 1950s by Jay Forrester
  – Simulates whole system behavior to help identify best levers to generate desired changes – not for point prediction
  – Enables rapid development of a working hypothesis of underlying drivers and tradeoffs over time
  – Organizes assumptions to facilitates discussion and iterative improvement to the model

• How has SDM been used?
  – Conceptual system dynamics models for counterinsurgency developed at Naval Postgraduate School and MIT
  – PA&E/GMU COINS Model
  – DARPA Fallujah case study
  – OA-07 GWOT analysis

Support adjudication of Economic and Military effects
Application of SEAS to IW Analysis

• What is SEAS?
  – Synthetic Environment for Analysis and Simulation developed by Simulex, Inc
  – Agent-based DIME and PmESII (non-kinetic) simulation, where each entity from
countries, organization leadership and members, to individuals ismodeled as an agent

• How has SEAS been used?
  – Commercial business development
    and advertising
  – Proctor & Gamble and Army Recruiting
    Command to assess effects of marketing
    campaigns on population attitudes
  – JFCOM warfighting experiments
    (e.g., Urban Resolve series)
  – DARPA PCAS case study
  – OA-07 GWOT analysis

Support adjudication of Political, Social, and Information effects
Summary: OSD Perspective

• Analysis of Irregular Warfare requires a new modeling approach to represent
  – DIMEFIL actions by Red, Blue, and Green: Diplomatic, Information, Military, Economic, Financial, Intelligence, Law Enforcement
  – PMESII effects for all actions: Political, Military, Economic, Social, Information, Infrastructure

• Possible approach
  – Structured subject matter expert wargame supported by analytic tools and social science models
  – System dynamics and agent-based models like SEAS appear to be promising capabilities to support wargame adjudication of DIMEFIL-PMESII interactions

• Irregular Warfare MORS Workshop (11-13 December 2007)
  – Improving Cooperation Among Nations in Irregular Warfare Analysis
  – Naval Postgraduate School
  – Working Groups: insurgency, terrorism, SSTRO, maritime ops
Backup
GWOT Extended “X” Game Study Findings

How do we support long term needs of the GWOT?

1. The wargame fully utilized most Special Operations capabilities
   - The wargame was limited to a subset of GWOT activities and did not account for other SOF force structure demands
   - The wargame accounted for planned SOF force structure increases

2. This suggests that continued force management actions will be needed to sustain the long term needs of the GWOT; options include:
   - Rebalancing tasks between SOF and GPF and possibly within SOCOM
   - Reducing demand (e.g., reduce level of effort, decrease concurrent activities, increase contribution from allies and partners)
   - Increasing supply (e.g., accept higher deployment tempo, increase access to Reserve Component, continue to grow SOF force structure)
Application of Wargaming Tools to IW Analysis

• **GWOT X-game** developed extensive rule set to assess GWOT over 21 countries, 2007-2014
  – Fund for Peace Failed State Index employed to adjudicate Political, Economic, Social, and Infrastructure effects
  – Study also developed extensive:
    • Generic rulesets: “If-then”
    • Conditional rulesets: “If x under specific conditions, then y”

• **Algernon** developed extensive rule set to assess COIN/UW
  – Based on “Algeria The War for Independence 1954-1962” commercial wargame
  – Multi-player, limited intelligence war-game at the operational & strategic levels of war
  – Incorporates information operations, combat operations, resources, and the impact of political will on Red, Green, and Blue operations
  – Permits analysis of differing offensive and defensive strategies

• **Structured Subject Matter Expert wargames** with developed rule sets facilitate analysis and can be informed by a suite of tools
Tools that address the Gaps in IW modeling

• War-gaming
  – Insight is gained by walking through situations
  – However, analysis needs statistically significant results, which are hard to get with Human-In-The-Loop techniques
    • So, war-games may be branched
    • Computer can assist in rapid adjudication and “keeping all else the same”
    • Statistics can tease out the effect due to the interactions from bias brought to the game

• Agent-Based Simulation
  – Works same way as war game: by walking through situations
  – However, can do many more micro simulations than war games can, and compute macro level effects, for green PMESII simulation
  – Agents are essential for simulating networked relations
  – Agents are needed to simulate game theoretical and artificial intelligence based techniques
Tool: Agent Based Techniques

• **Game Theory**
  – Agents can react to each other based on their perceptions of other agents’ perceptions … modeling modelers as needed in IO warfare
  – Agents can find equilibria
    • Nash equilibria…- solutions where no competing party can do better
    • Shelling points – cooperative solutions
    • These are great states to cajole a situation into for COA analysis
  – Signaling theory finds payoffs for communication, needed in IO warfare

• **AI techniques**
  – Expert systems: agents can hold modular rulesets that represent behaviors of social groups they belong to
  – Uncertainty: agents can have perceptions and actions based on probability theory (bayesian networks) or “qualitative” reasoning (fuzzy systems)
  – Machine learning techniques: Agents can learn how to deal with new situations and generalize about them using neural networks and genetic algorithms, or more advanced co-evolutionary techniques
Tools: Integrative Methods

• System Dynamics Techniques
  – Captures homeostatic nature of natural and social systems
  – Integrates phenomena through modeling the feedback between phenomena
  – But not good for modular switching in and out: more of a static “spaghetti” program
  – Can’t simulate networks and change in structure, but good for simulations that use “even mixing”
  – Good for macro level processes that do not need feedback from the micro level

• Integrative Toolkits
  – Since so many theories and strategies need recombination for exploration of the IW space, toolkits must address integration issues
  – Models of different social phenomena are interdependent, and are different ways of viewing the same thing
  – Models of micro and macro level (multi resolution) phenomena are also different ways of viewing the same thing
  – Integrative toolkits need to find consensus and resolve conflicts between models that are different ways of viewing the same thing
  – Feedback, as in the NSF DDDAS (Dynamic Data Driven Application Systems) program is promising
## Current Irregular Warfare M&S Tools

<table>
<thead>
<tr>
<th>Mission Types</th>
<th>M&amp;S Tools</th>
<th>Campaign Model</th>
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<td>Counter Proliferation</td>
<td>Direct Combat Model (JCATS)</td>
<td>Not Directly Applicable</td>
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<tr>
<td>Counter Terrorism</td>
<td>Direct Combat Model (JCATS)</td>
<td>Not Directly Applicable</td>
</tr>
<tr>
<td>Foreign Internal Defense</td>
<td>PMESII (SEAS, MIT System Dynamics Model, Agile)</td>
<td>JICM, JWARS, JTLS</td>
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<td>Diamond-US</td>
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<tr>
<td>Special Reconnaissance</td>
<td>Direct Combat Model (JCATS)</td>
<td>JICM, ITEM, THUNDER, JTLS, JWARS, COSMOS*</td>
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<td></td>
<td>Pythagoras</td>
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<td>Direct Action</td>
<td>Direct Combat Model (JCATS)</td>
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<td>JTLS</td>
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<td>Psychological Operations</td>
<td>System Dynamics</td>
<td>JICM</td>
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<td>SOF Behavioral Analysis Tool (Pythagoras)</td>
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<td>Civil Affairs Operations</td>
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<td>JTLS</td>
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<tr>
<td>Unconventional Warfare</td>
<td>PMESII (SEAS, MIT System Dynamics Model, Agile, IGS/EBW, IBC)</td>
<td>JICM, JWARS? (during latter phases of the UW Campaign Only)</td>
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<td>Direct Combat Model (JCATS)</td>
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<td>Tabletop Irregular Warfare Derivative</td>
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<td>UK’s Peace Support Model (PSOM)</td>
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<td>Diamond-US</td>
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<td></td>
<td>Pythagoras</td>
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<td></td>
<td>Interim Semi-static Stability Model</td>
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<td>Information Operations</td>
<td>PMESII-TBD</td>
<td>ITEM, THUNDER</td>
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<td>SOF Behavioral Analysis Tool (Pythagoras)</td>
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* COSMOS is a mission level ISR model being evaluated in the SAC

### SOF Tools:
- **Green** = Planned SAC Tool – on hand or readily available
- **Blue** = Potential SAC Tool
- **Orange** = SAC Tool requiring validation and development effort
- **Purple** = Candidate SAC Tool requiring further assessment
- **Red** = Future DARPA capability
## Analyzing the DPS: Tools Considered

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<th>Pol</th>
<th>Mil</th>
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<td>Integrated Semi-Static Stability Model (ISSM) – tracks stability levels</td>
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GWOT X-Game Methodology
Methodology

• **Extended “X” Wargame**
  – Eight 2-week game turns; each turn representing one year of activity

• **Working Groups (action officers)**
  – Blue/Green: developed yearly campaign plans/CONOPS by quarter
  – Red: developed yearly campaign plans/CONOPS by month
  – White: adjudicated each year

• **Oversight**
  – 06 Level (Senior Steering Group)
  – 1 Star / OPSDEPS / JCS TANK (Operational Availability-07)

• **Participants**
  – Program Analysis & Evaluation
  – Policy International Security Affairs
  – Policy Special Operations/Low intensity Conflict
  – J8 Warfighting Analysis Division
  – J5 Deputy Director for the War on Terror
  – US Special Operations Command
  – Regional and Unified Commands
  – Services
  – Defense Intelligence Agency
  – National Counter Terrorism Center
  – Central Intelligence Agency
  – Department of State

Wargame-based analysis: Results specific to scenario and participants
Game Turn Process (2 Week Cycle per Game Year)

**Days 1-3**
Red identifies actions for each group by month; Blue identifies actions for each country by quarter.

**Day 4**
White meets to discuss adjudication plan.

**Days 5-6**
White team adjudicates Blue actions.

**Days 7-9**
White adjudicates Red actions.

**Day 7**
White sends results of Blue adjudication to DoS & Policy ISA for validation.

**Day 9**
White meets w/ OGA or e-mails results for validation.

**Day 10**
White integrates results and builds turn outbrief.

Blue and Red teams develop yearly plans throughout cycle.

Involves updating ~35 PMESII fields per country, 7 fields per terrorist group, and adjudicating 200+ incidents.

Involves updating ~35 PMESII fields per country and adjudicating 150+ actions across the DIMEFIL.
Red: Major Categories of Activities

- Intel / surveillance
- Counterintelligence / operational security
- Recruiting / retention
- Training
- Financing
- Developing safe havens
- Information operations / propaganda
- Criminal activities
- Acquiring CBRNE
- Kinetic attacks (against infrastructure, officials, civilians, etc.)
## Blue X-Game Activities

<table>
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<tr>
<th>Military Activities</th>
<th>Interagency Activities (Examples)</th>
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<tr>
<td>Coercive Campaign</td>
<td>Diplomatic</td>
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<tr>
<td>MAS (WMDI) – Maritime Approach Security WMD Interdiction</td>
<td>• Dialogue, coordinate, and convince countries to initiate/expand/cooperate on military operations, train and equip, border control, economic aid, WMD control/elimination</td>
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<tr>
<td>Counter Insurgency</td>
<td>• Normalize/strengthen or cut/degrade diplomatic, economic, and trade relations with a country or non-state actor</td>
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<tr>
<td>MIO - Maritime Interdiction Operation</td>
<td>Information</td>
</tr>
<tr>
<td>Counter Terrorist Support &amp; Networks</td>
<td>• Fund faculty exchanges, cultural exchanges, university scholarships</td>
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<tr>
<td>MLE - Military Liaison Elements</td>
<td>• Conduct counter propaganda operations, PSYOP, OPSEC, public affairs, Internet</td>
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<tr>
<td>Cooperative WMD Elimination</td>
<td>Economic</td>
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<tr>
<td>NFZ - No Fly Zone</td>
<td>• Provide economic development aid, disaster relief aid, foreign direct investment, favorable trade agreements, funding for FMF, IMET, Counter Terrorism Fellowship Program</td>
</tr>
<tr>
<td>Cooperative WoT</td>
<td>Financial</td>
</tr>
<tr>
<td>SoF – Show of Force</td>
<td>• Locate, track, and interdict financial transfers to terrorist organizations</td>
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<tr>
<td>Enhanced Maritime Interdiction Operation</td>
<td>Intelligence</td>
</tr>
<tr>
<td>SSTR - Stability, Security, Transition and Reconstruction</td>
<td>• Engage in information sharing, intelligence training, regional intelligence centers</td>
</tr>
<tr>
<td>TSC Exercises</td>
<td>Law Enforcement</td>
</tr>
<tr>
<td>STRK - strike -air, maritime or ground raid</td>
<td>• Build/upgrade/expand law enforcement capabilities and/or judicial system (local, regional, national) on a unilateral/bilateral basis and/or in conjunction with NGO</td>
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<tr>
<td>Foreign Humanitarian Assistance - Relief</td>
<td>• Conduct multilateral and/or bilateral anti-illegal immigration/narcotics/ corruption/criminal operations</td>
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<tr>
<td>T&amp;E - TSC Train and Equip</td>
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<tr>
<td>Foreign Internal Defense</td>
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<tr>
<td>UW - Unconventional Warfare</td>
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<td>TSC Information Operations</td>
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<tr>
<td>WMDE – WMD Elimination</td>
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<tr>
<td>Joint Combined Exercise for Training</td>
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<tr>
<td>WMDI – WMD Interdiction</td>
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<tr>
<td>Locate, Tag and Track [WMD, terrorists, equipment]</td>
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Unclassified

04/08/2007 10:42
White: Adjudication Overview

The White team maintains the following spreadsheets throughout the duration of the extended wargame

- Red Incident Tracker (Blue and Red versions)
- Blue Incident Tracker (Blue and Red versions)
- PMESII Tracker
- Terrorist Group Tracker (Blue and Red versions)
White: Red and Blue Incident Trackers

• Each incident that takes place during a given year is tracked in two Incident Trackers
  – Blue Version: tracks Blue’s perspective of the result of each incident or action
  – Red Version: tracks Red’s perspective of the result of each incident or action

• Each version includes:
  – Incident description (e.g., surveillance, training, attacking, kidnapping)
    – Date
    – Location
    – Magnitude
  – White adjudicated result

Example

<table>
<thead>
<tr>
<th>Red Incident</th>
<th>Date</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attempt surveillance, video taping, and documenting of Military Liaison Element (MLE) activity to collect evidence of U.S. military presence in country X</td>
<td>Jan 20XX</td>
<td>No detection of MLE activities</td>
</tr>
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</table>
The PMESII tracker is the primary method for determining the effects of every Blue and Red action on conditions within each country.

<table>
<thead>
<tr>
<th>PMESII Factor</th>
<th>Adjudication Method</th>
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</thead>
<tbody>
<tr>
<td>Political Stability</td>
<td>FSI Indicator Tool and SME Rule Set</td>
</tr>
<tr>
<td>Military Capability</td>
<td>SME Rule Sets and White Cell Discussion</td>
</tr>
<tr>
<td>Economic Stability</td>
<td>FSI Indicator Tool and SME Rule Set</td>
</tr>
<tr>
<td>Social Stability</td>
<td>FSI Indicator Tool</td>
</tr>
<tr>
<td>Infrastructure Levels</td>
<td>FSI Indicator Tool</td>
</tr>
<tr>
<td>Information (Public Support Levels)</td>
<td>White Cell Discussion</td>
</tr>
</tbody>
</table>

FSI = Failed State Index  
SME = Subject Matter Expert
DIMEFIL Effects on the PMESII Tracker

These two tables detail the White method for adjudicating the PMESII* effects of each activity
- Conditional rule sets
- Failed State Index (FSI)
- Discussion
- Generic SME rule sets

*Information effects are determined by White discussions and heuristics
White: Updating PMESII Levels using the FSI Tool

- Each action’s impact on Political, Economic, Social, and Infrastructure stability levels is determined by analyzing whether or not the action results in a rise/fall of one or more of the Fund for Peace’s Failed State Index (FSI) indicators.

Example

- Action: Well coordinated Red IO plan that aims to highlight the economic differences among sects.
- Adjudication Process (example effect on economic levels shown to the right):
  1. White determines (yes=1, no=0) whether or not the action affects the FSI tool questions (Answer column).
  2. FSI tool calculates a random draw from an appropriate range (Adjustment column).
  3. White team inserts final adjustment into the PMESII tracker adjudication matrix (Total Adjustment).
• Each action’s impact on Military / Counter-terrorism (CT) effectiveness levels for each country is tracked on a 1-3 scale where:
  - 1=Inadequate
  - 2=Adequate
  - 3=Strong

• Unique rule sets developed for DIMEFIL activities determined to impact Green CT effectiveness levels (example rule set shown to the right)

• Each action’s impact on Green military/CT levels is calculated using rules developed by SMEs

Example: When Blue conducts a CWOT mission, Green military capabilities are updated according to a table
White: Updating PMESII Levels using Heuristics

• Each action’s effect on Information (public support) levels is determined through white cell discussion

• Heuristics were created to guide the process

Example
• Action: Blue conducts a Joint Combined Exercise for Training (JCET)

• Rule
  – If the Green public does not support Blue and JCET becomes public knowledge, then Green public support falls by X and Blue public support falls by Y where X<Y
White: Terrorist Group Tracker

- Tracks for each of the terrorist groups the following factors:
  1. Defection rates
  2. Financing
  3. IO success rate
  4. Recruitment rates
  5. Training rates
  6. Membership quantity (range)
  7. Locations of operation
  8. Freedom to operate
  9. Overall effectiveness level

- Defections, financing, popular support, recruitment, training, and effectiveness levels are reported as follows:
  - Static/+/- represent the trend of improvement/deterioration in each area
  - Red/Yellow/Green represent group effectiveness in each area (e.g., after several years of trending positively a group may move from yellow to green for a certain category)

- The Blue version tracks Blue perception of capability while the Red version tracks “ground truth”

Example

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<th>Terror Group X</th>
<th>2007</th>
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<th>2010</th>
<th>2011</th>
<th>2012</th>
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<td>-</td>
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<td>+</td>
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