



13th ICCRTS – C2 for Complex Endeavors



On the Introduction of Effects Based Assessment into NATO's Processes, Organization and Tools

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The Question



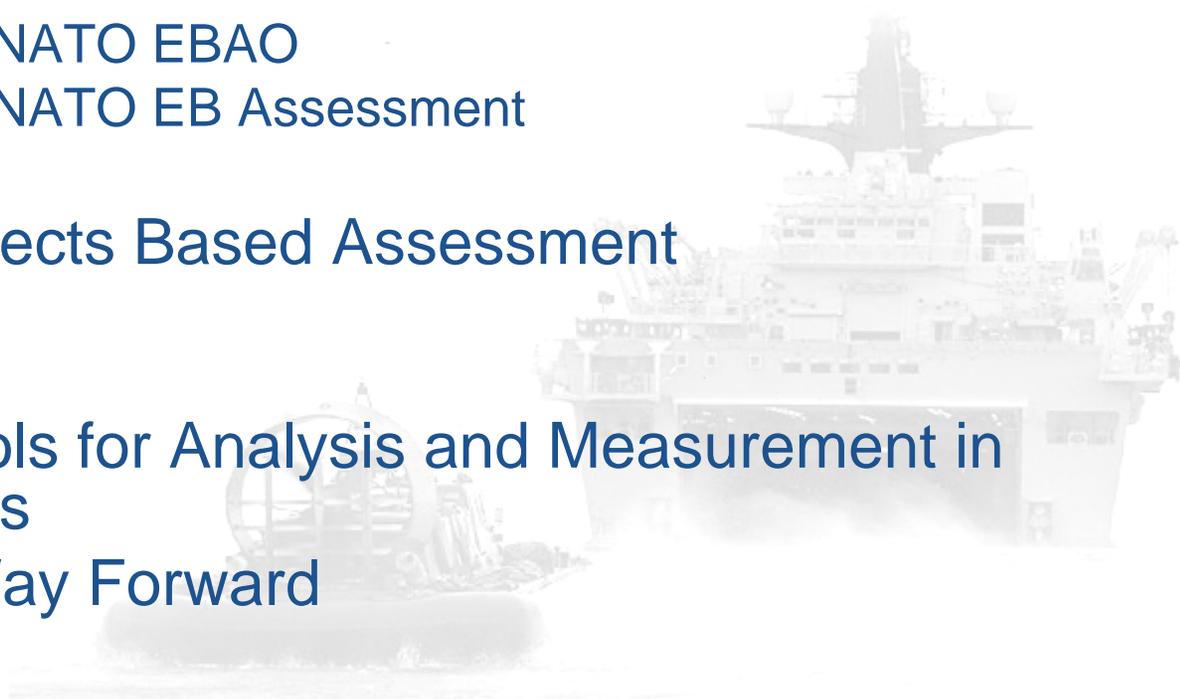
- NATO has embarked on an Effects Based Approach to Operations (EBAO)
 - Continuous Analysis for the Holistic Understanding of Operational Environment
 - Assessment as Feedback for Improved Situational Understanding
 - Assessment as Feedback for Synchronization of actions based on their contribution to achievements of effects
 - Interplay between Military and Non-Military domains
- But what is the underpinning and foundation for Continuous Analysis and Assessment
 - Doctrine, Tactics, Techniques and Procedures
 - Analysis Capability: manpower, resources and tools
 - Within ever-increasing complex operational environment



Agenda



- Need for Assessment: Complexity
 - Complex Systems
 - Complex Adaptive Systems
- Need for Assessment: EBAO
 - Current State of NATO EBAO
 - Current State of NATO EB Assessment
 - MOP and MOE
- Challenges in Effects Based Assessment
 - MOE Selection
 - Causality
- Methods and Tools for Analysis and Measurement in Complex Systems
- Conclusions & Way Forward



20 years ago...

FORCE ON FORCE

Armor - Anti-Armor

Soviet Motor Rifle Division Equivalents

Lanchaster Equations

Probability of Kill

Follow-on Forces Attack

Warsaw Pact - NATO

SAM Belt

Weapon Values

ATTRITION

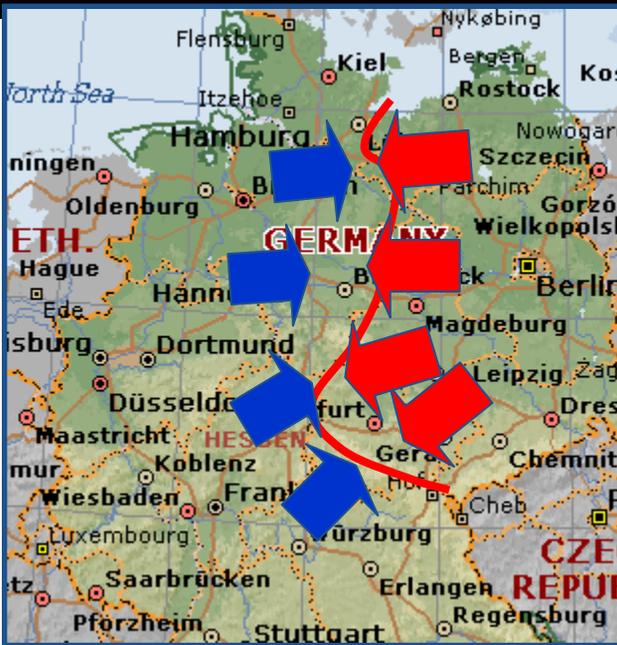
Division Combat Potential

FORWARD EDGE OF THE BATTLEFIELD





Changing Operational Environment



- Symmetric Threat
- Attrition Based
- Material Acquisition
- Soviet Doctrine
- Own Terrain
- Conventional
- Fixed C2 and Log
- Crisis Response Ops
- Own Capabilities
- Strategic Movement
- Operational Planning
- Military Option
- Asymmetric Threats
- Civil Military Interfaces
- Stabilization & Reconstruction
- Expeditionary and Global
- Irregular and Conventional



Need for Assessment: Complexity



- Operational Commander's need for feedback
 - Prediction and Evaluation of Military Decisions
 - Actions: Are actions implemented as planned
 - Effects: Are results achieved as planned
- Operational Analysis – Causality
 - Provides Scientific Method: quantitative basis for decision making
 - Rational Problem Structuring and Unbiased Reasoning
 - Physical relationships
- Operational Analysis – Complex Sciences
 - Material and Non-Material factors
 - Military and Non-Military domains
 - “How parts of a system give rise to the collective behaviors of the system and how the system interacts with its environment”





Complex Systems



- **Complicated Systems¹**
 - Governed by simple cause-effect relationships
 - System's motion is repeatable and predictable
 - Changes in environment or initial conditions have understandable and incremental effects
- **Complex Systems²**
 - Many contributing causes to any outcome and one action may lead to multiplicity of effects
 - Predictability is reduced – Not possible to predict all consequences and not possible to determine which actions produce a desired result
 - System behavior is coherent in that there are recurring patterns and trends but they vary and the rules keep changing

¹ Ed Smith – A handbook for Whole of Government Action, 2007

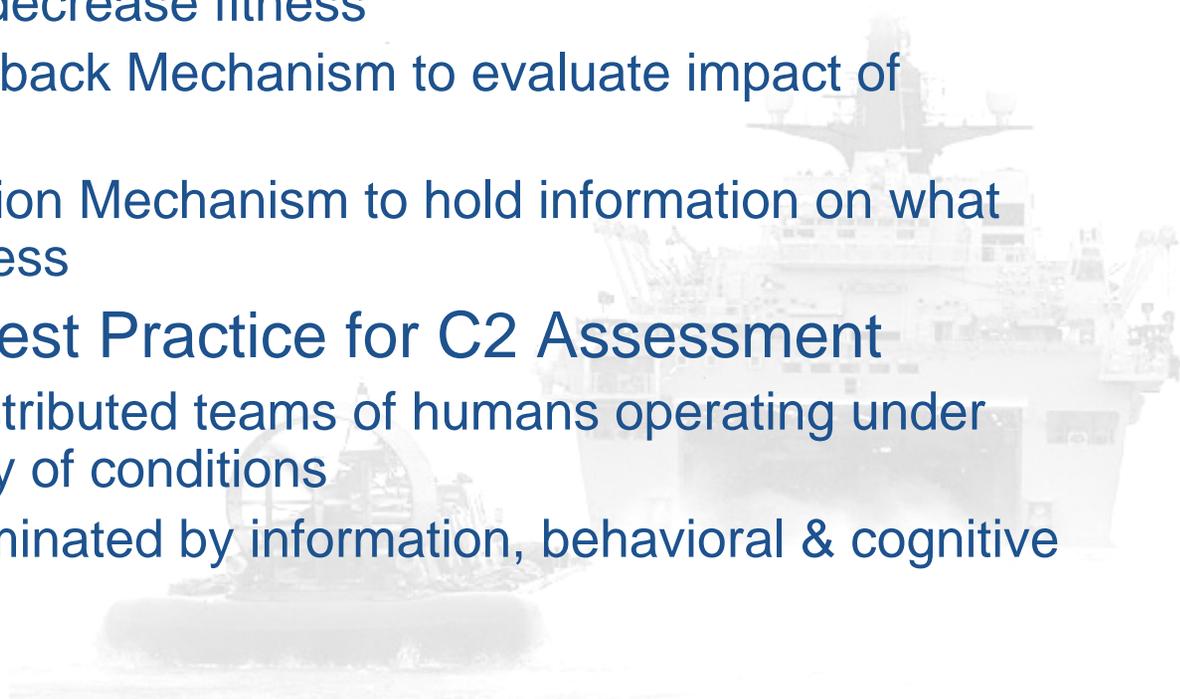
² A-M Grisogono – Implications of CAS Theory for C2, 2006



Complex Adaptive Systems



- Ability to self-organize or adapt
 - Fitness: Concept of Success or Failure
 - Change: Source of variation in internal details
 - Evolution: Selection Process – retaining or discarding variations that increase or decrease fitness
 - Evaluation: Feedback Mechanism to evaluate impact of variations
 - Learning: Retention Mechanism to hold information on what in/decreases fitness
- NATO Code of Best Practice for C2 Assessment
 - C2 deals with distributed teams of humans operating under stress and variety of conditions
 - C2 problems dominated by information, behavioral & cognitive aspects





Need for Assessment: EBAO

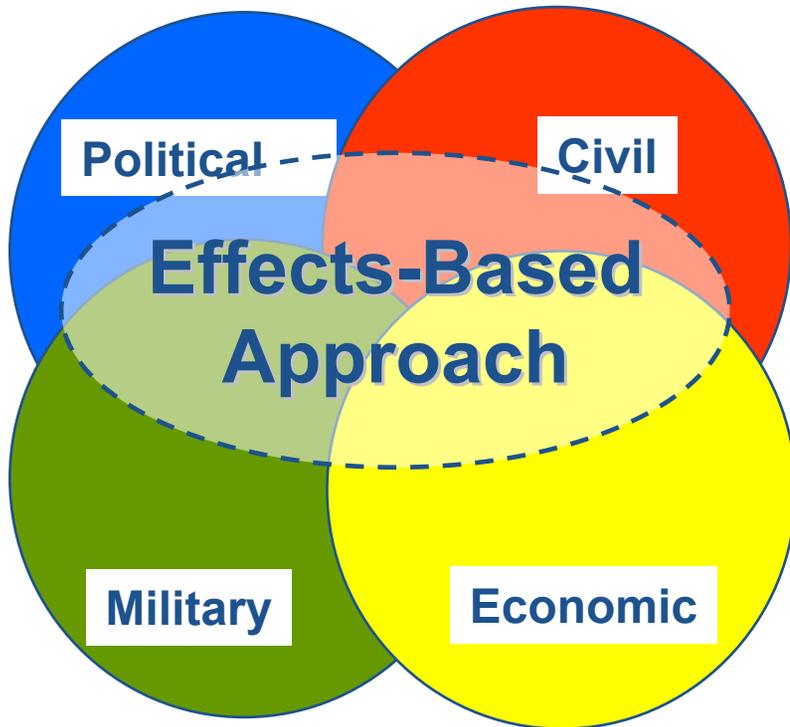


- **Asymmetry of Conflict**
 - Psychological Attrition vs Physical Attrition
 - Great Will Little Means vs Great Means Little Will
- **Spectrum of Conflict**
 - Peace, Crisis, War, Post-Conflict
 - Whole of Government Approach
 - Political, Civil, Economic and Military Domains
 - Three Block War: Combat, Stabilization & Reconstruction, Humanitarian Relief
- **Understanding of Conflict**
 - Causes and Symptoms of Conflict
 - Influencing Behavior of Actors within Environment
 - Interrelationships between Individual Components





Effects Based Approach to Operations



- A philosophy – a different way of thinking.
- Focuses on end state and the effects that will achieve it
- Consider environment as a complex “system” – in which all actors and entities interact to create effects

Requires:

- analysis of “the system” to understand relationship between actions and effects
- harmonizing contributions of various instruments
- continuous assessment of the effectiveness of actions and adapting the plan if necessary

“Experience in Afghanistan and Kosovo demonstrates that today’s challenges require a comprehensive approach by the international community involving a wide spectrum of civil and military instruments, while fully respecting mandates and autonomy of decisions of all actors...”

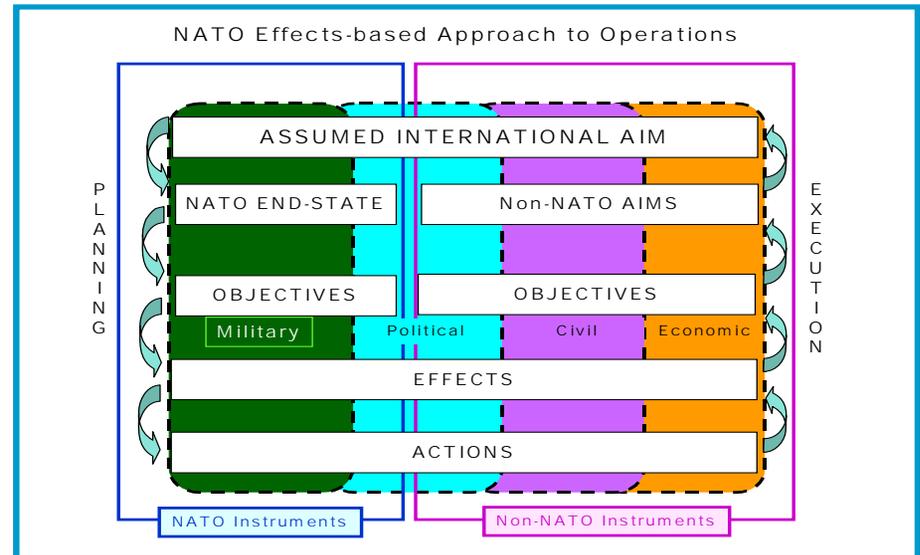
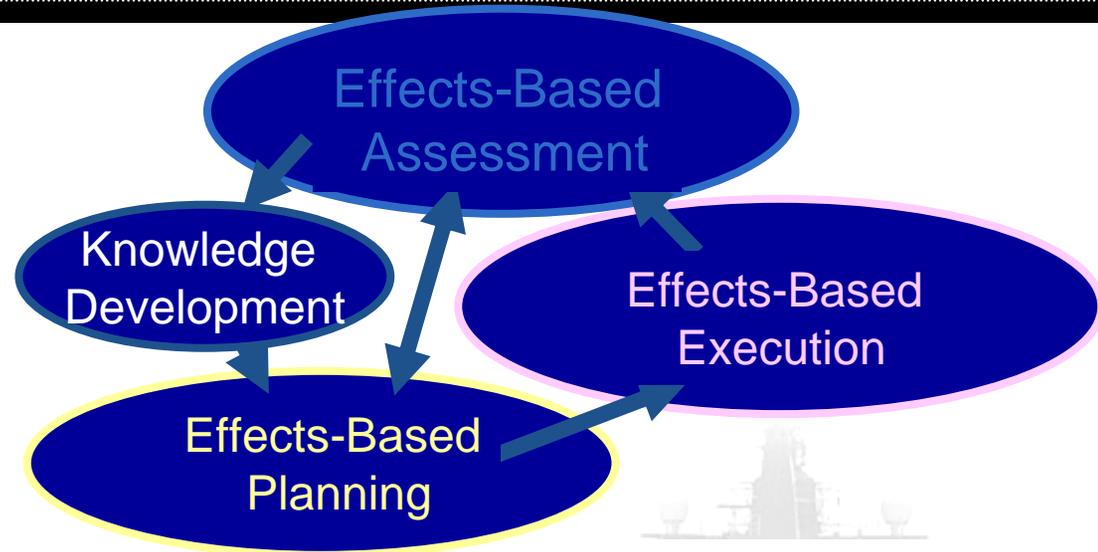
Riga Summit Declaration.- November, 2006



EBAO Definition and Elements

“The Effects Based Approach to Operations is the **coherent and comprehensive application** of the various instruments of the Alliance, combined with the **practical cooperation along with involved non-NATO actors**, to create **effects** necessary to achieve planned **objectives** and ultimately the **NATO end-state**”.

*MCM 0052-2006,
Military Committee position on EBAO*

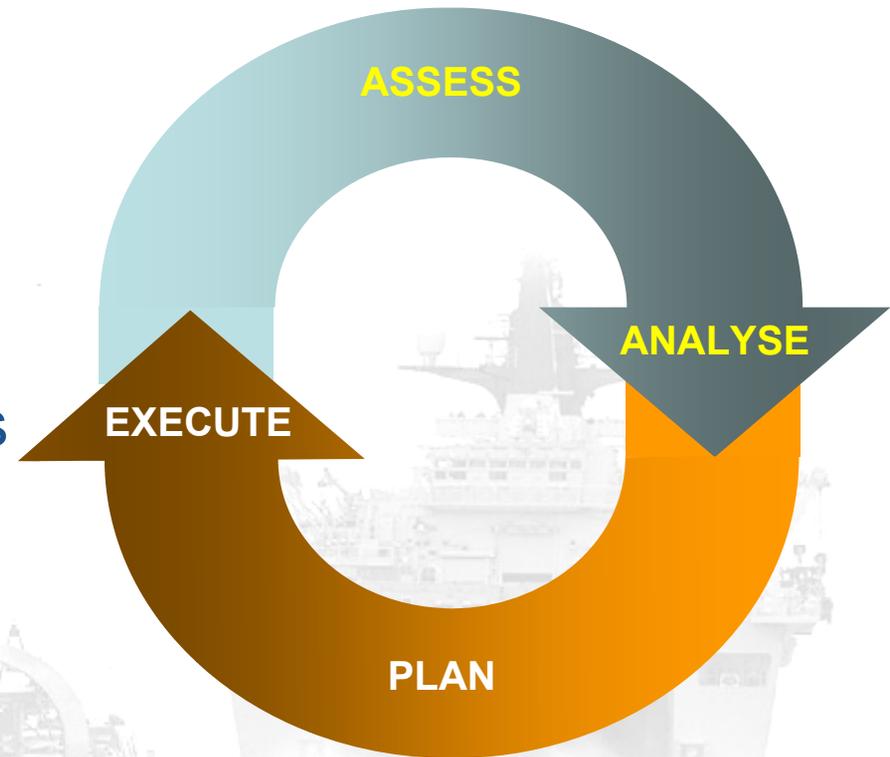




EBAO Cycle



- Analysis: to understand state of operational environment through systems thinking and analysis and build a conceptual model of current and expected states
- Planning: to plan for short, medium and long term effects of actions
- Execution: to execute plan and steer, synchronize and adjust where necessary
- Assessment: to inform on current state and compare with expected state

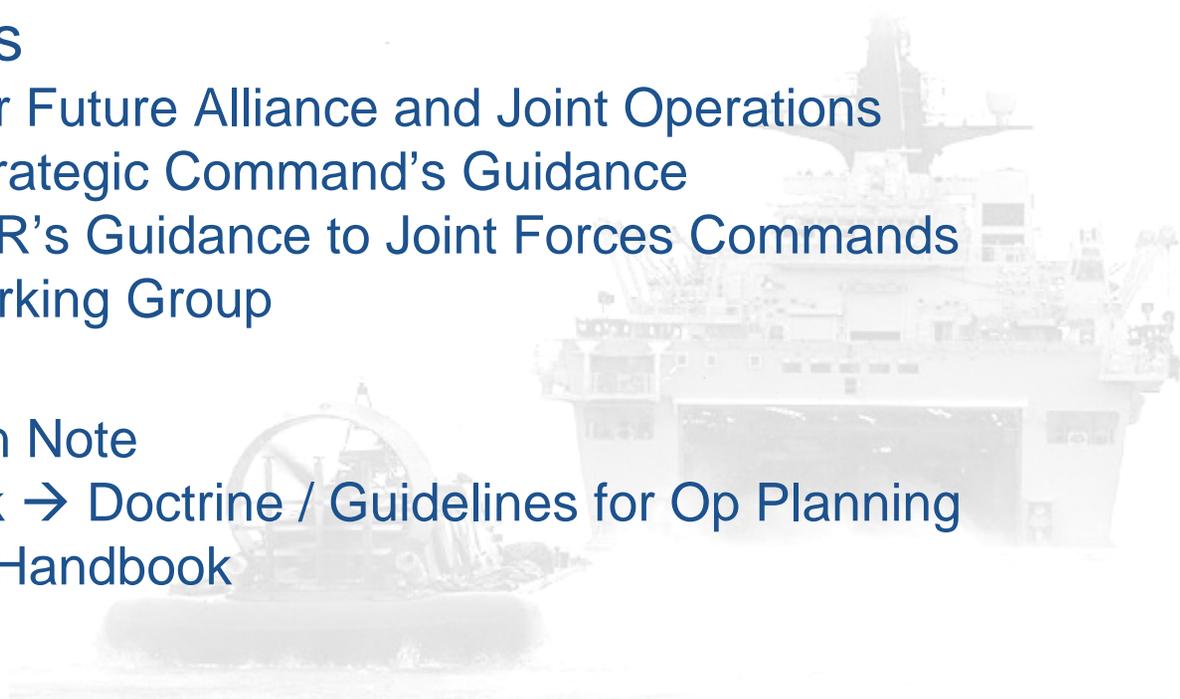




NATO's EBAO Products

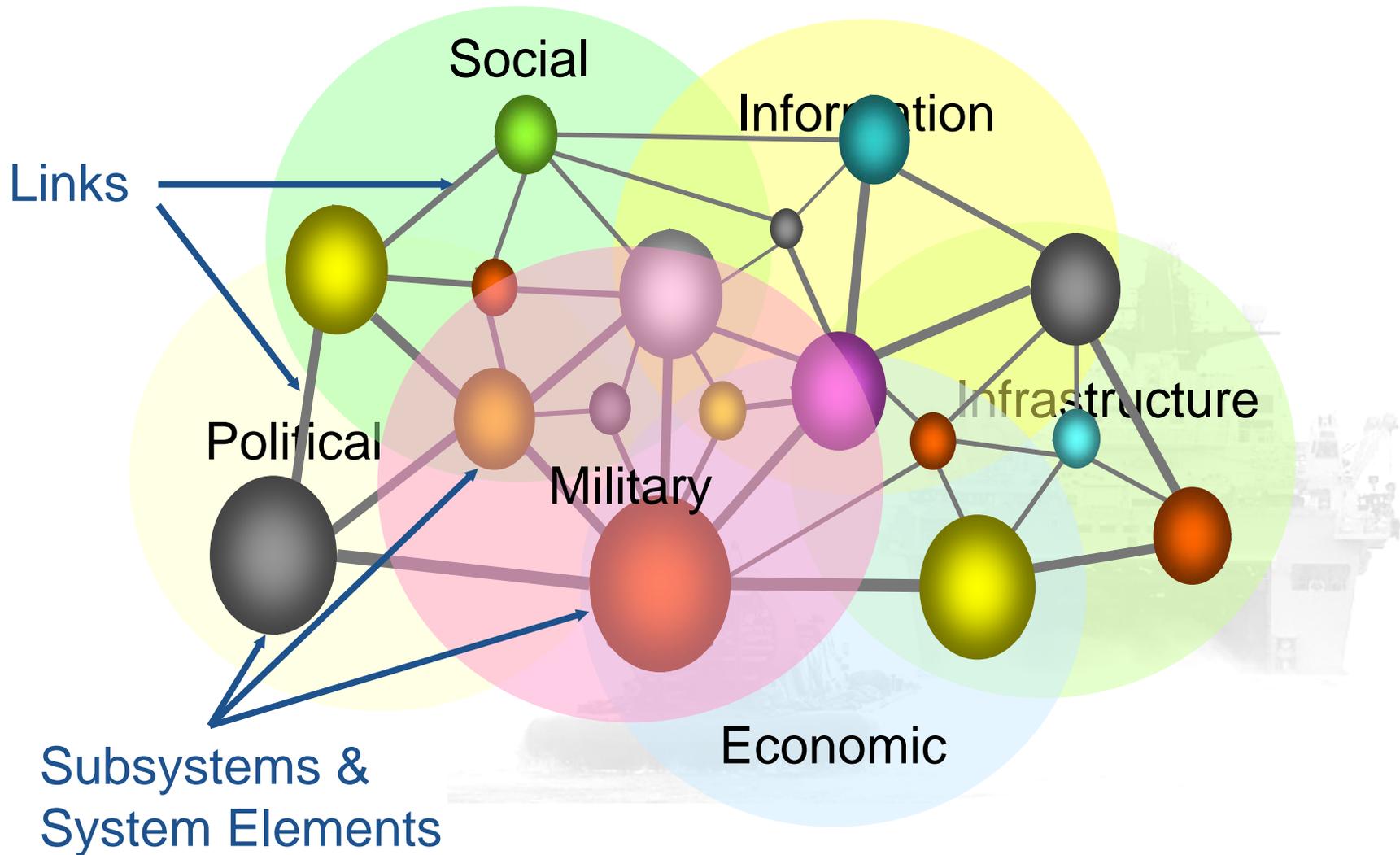


- Multinational Experiments
 - MNE 3: Effects Based Planning
 - MNE 4: Effects Based Operations
 - MNE 5: Effects Based Assessment LOE
- NATO's Initiatives
 - ACT: Concept for Future Alliance and Joint Operations
 - MC Memo: Bi-Strategic Command's Guidance
 - SHAPE: SACEUR's Guidance to Joint Forces Commands
 - Bi-SC EBAO Working Group
- EBAO Products
 - Bi-SC Discussion Note
 - EBAO Handbook → Doctrine / Guidelines for Op Planning
 - EB Assessment Handbook





Modeling the Environment





Some EBAO foundations



■ End State

- A single, agreed unambiguous concluding situation.

■ Effect

- The cumulative consequence of one or more actions that leads to a change to the situation in one or more domains.

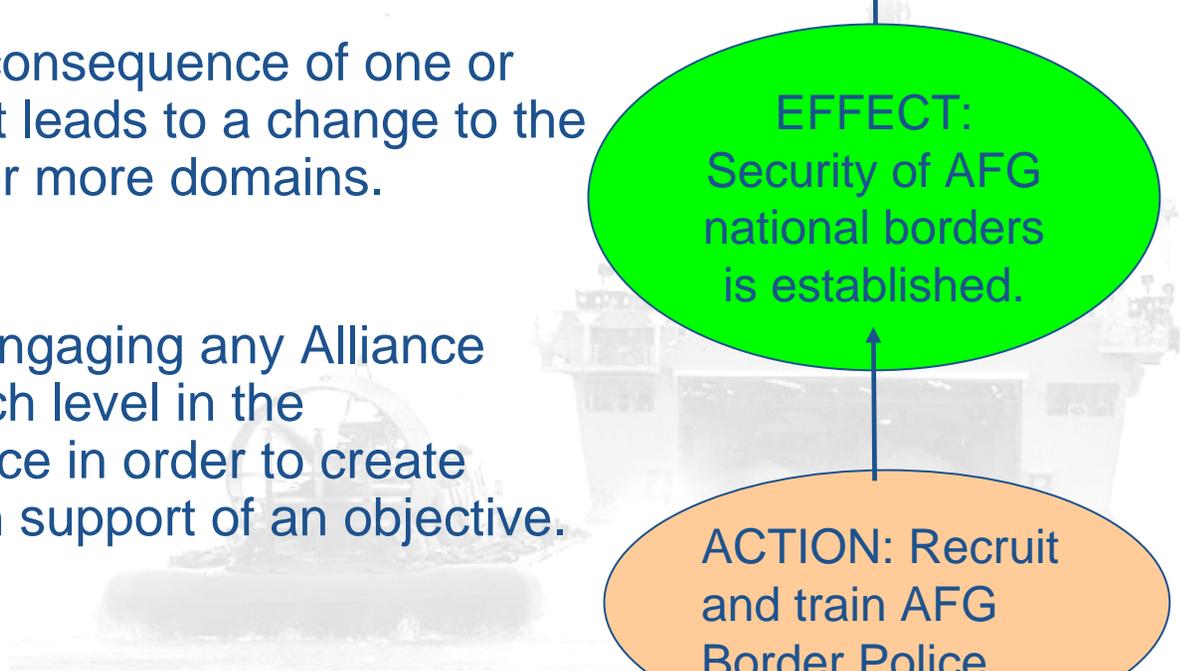
■ Action

- The process of engaging any Alliance instrument at each level in the engagement space in order to create specific effects in support of an objective.

END STATE: Afghan government can provide security, order, stability and reconstruction.

EFFECT: Security of AFG national borders is established.

ACTION: Recruit and train AFG Border Police





Effects-Based Assessment

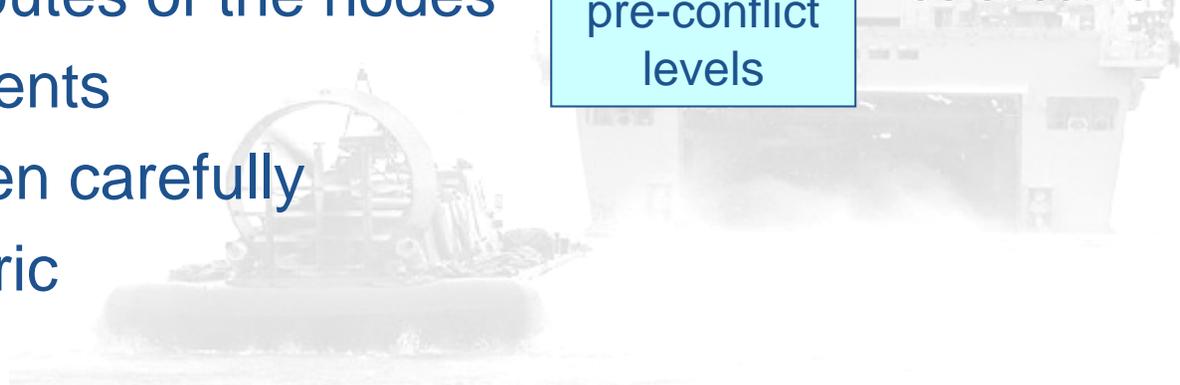


- Effects Assessment: the first step
- Measures of Effectiveness
 - Essentially a 'system state'
 - Measure attributes of the nodes or system elements
 - Must be chosen carefully
 - A lagging metric

EFFECT: Security of AFG national borders is established.

MOE: % illegal border crossings returns to pre-conflict levels

MOE: All border control points are evaluated as effective.

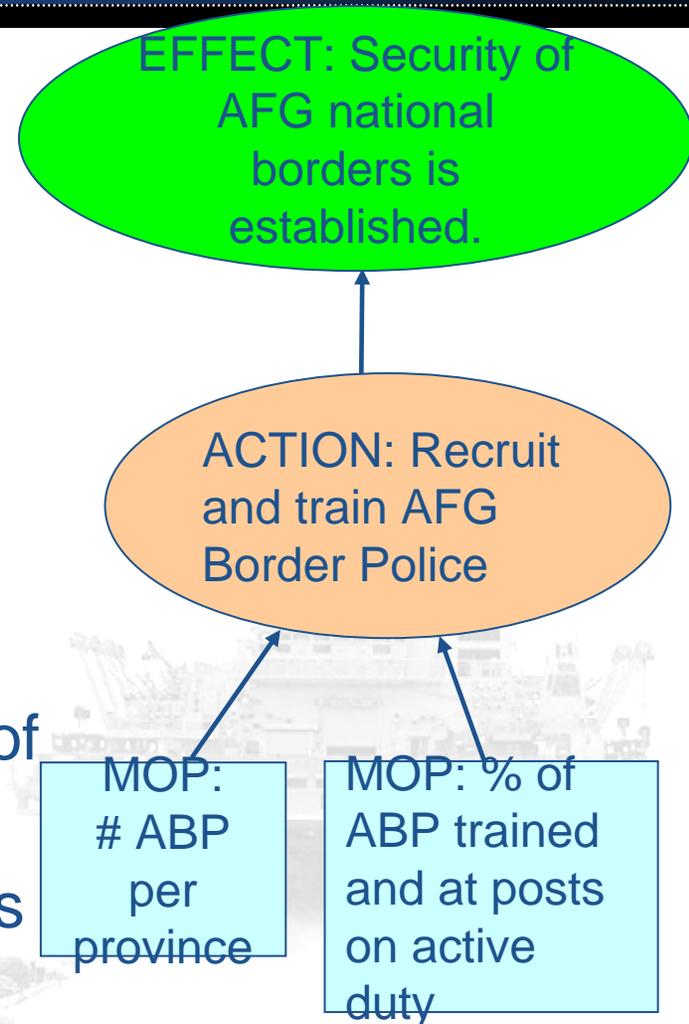




Effects-Based Assessment



- **Action Assessment:**
done in parallel with Effects Assessment
- **Measures of Performance**
 - Used to gauge accomplishment of actions
 - Reflects the status of own actions
 - A leading metric





Effects-Based Assessment



- Effects vs Actions
 - Do not assume causality**completed actions ≠ created effect**

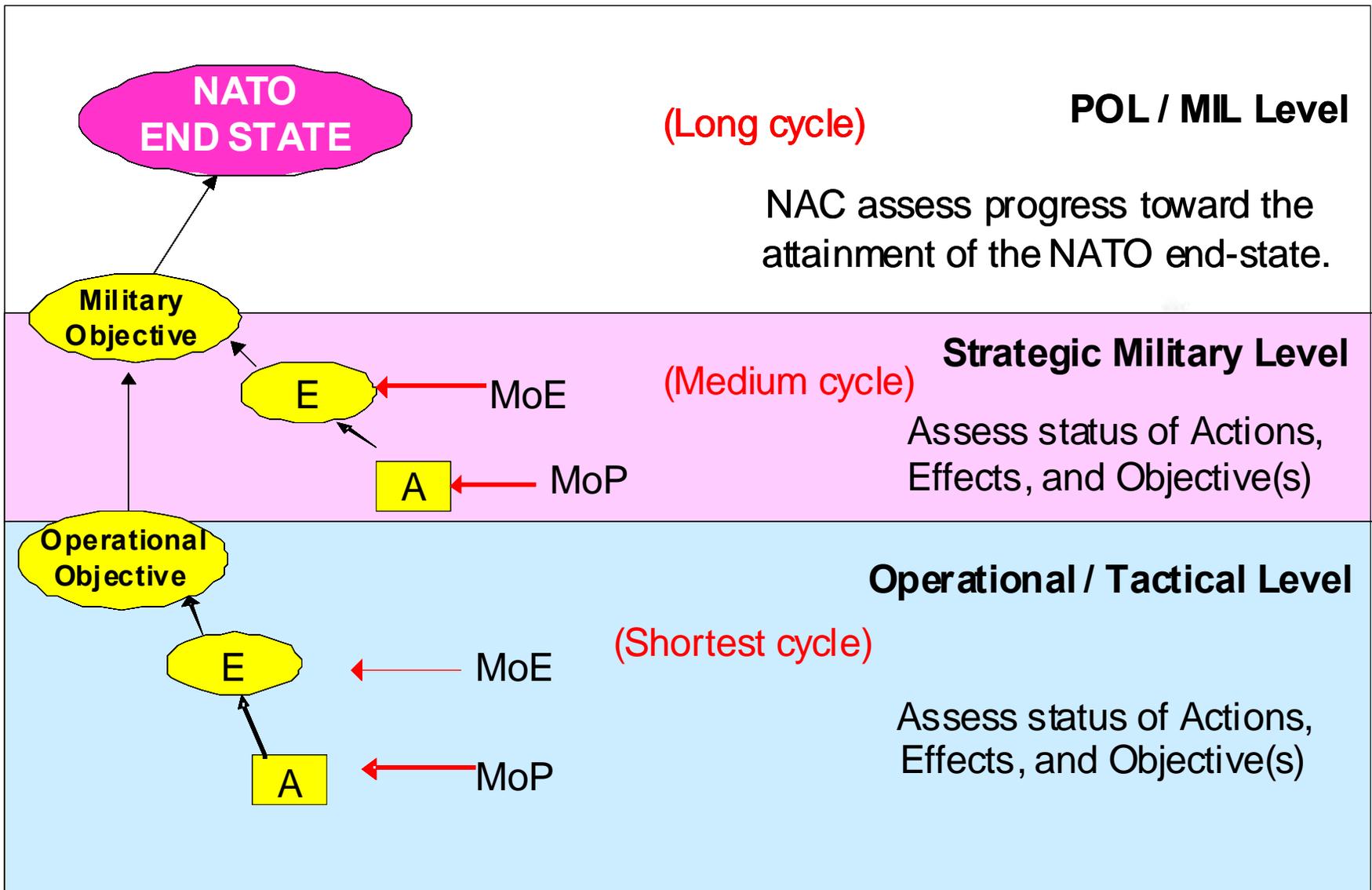
Progress toward Action

		Progress toward Action	
		Yes	No
Progress toward Effect	Yes	Continue to monitor	Poor MOP or threshold Model or plan invalid
	No	Poor MOE Model or plan invalid	Poor MOP and MOE Model or plan invalid



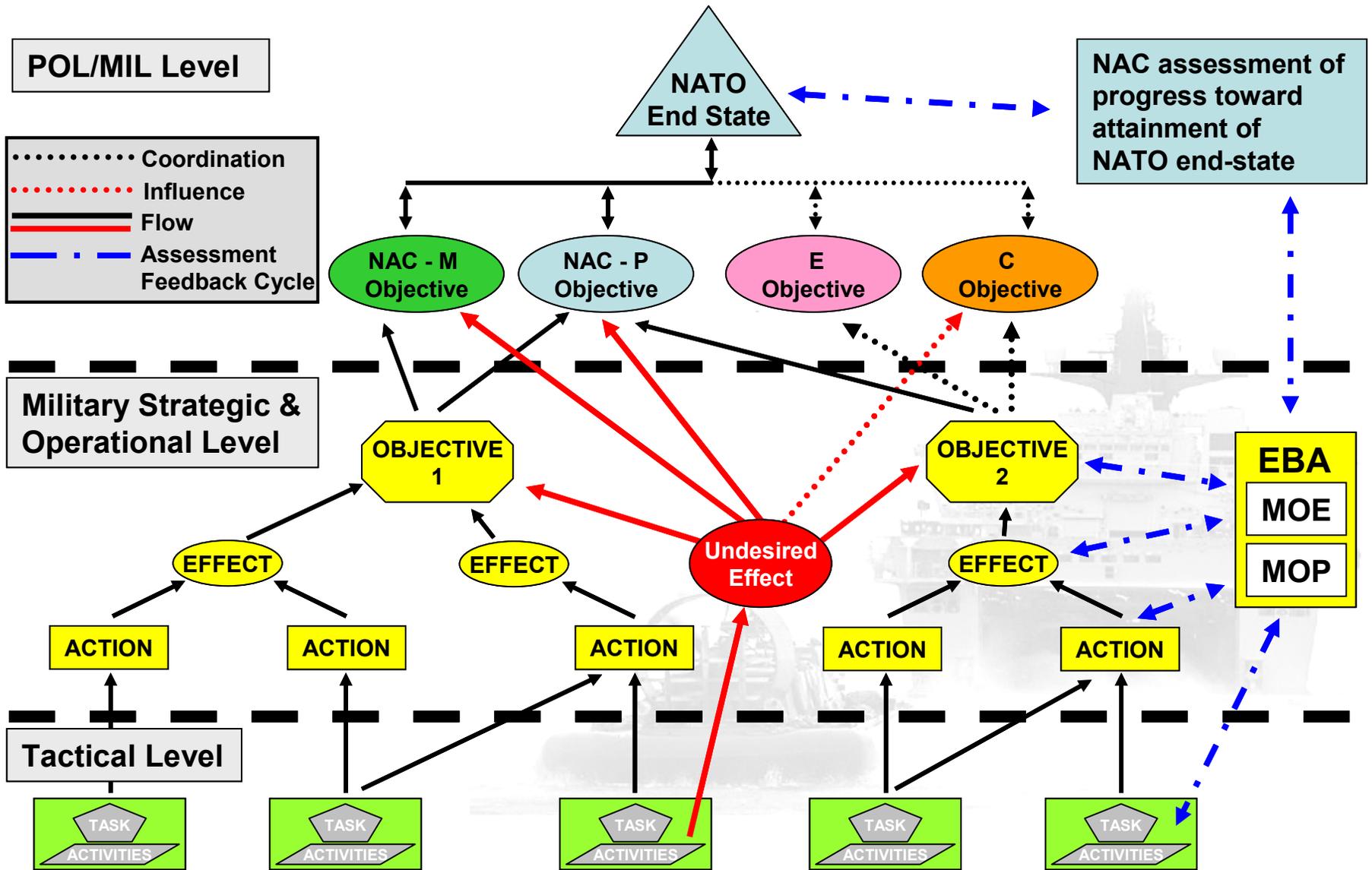


Assessment Cycles in EBAO





NATO EBAO Linkage





Challenges in EB Assessment

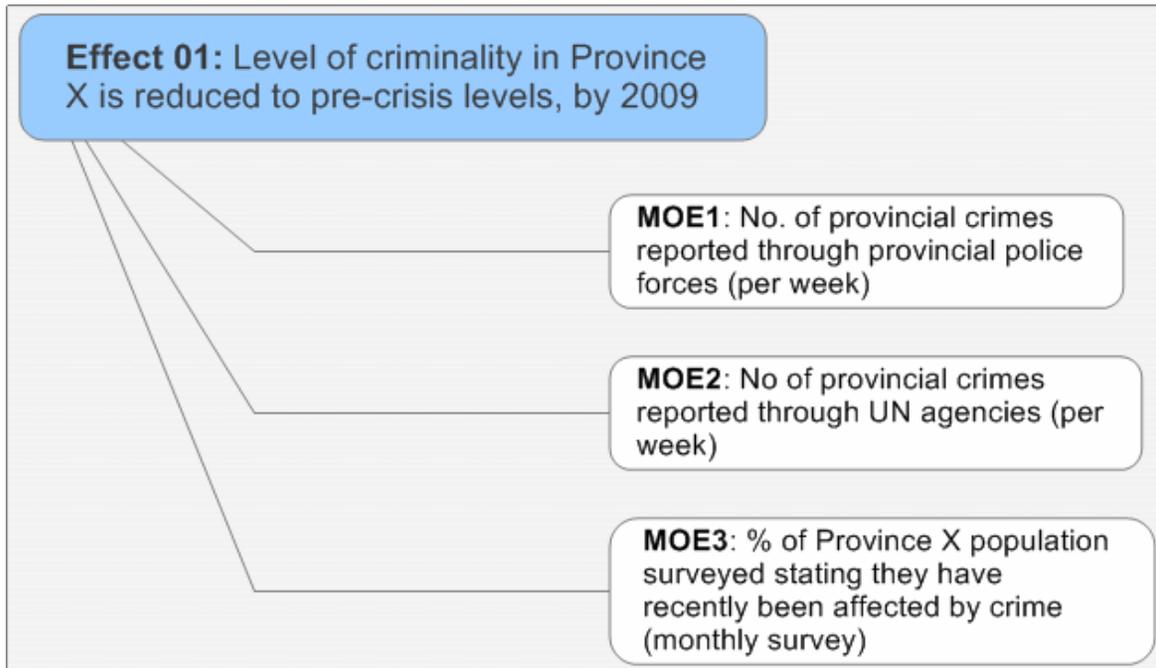


- MOE Selection
- MOE Weighting
- Threshold Values
- Causality





MOE Selection



- Conceptual Model of Operational Environment
- MOE and Effects commensurable
- Subjectivity in MOE selection
- Availability of Data
- Weighting of MOEs

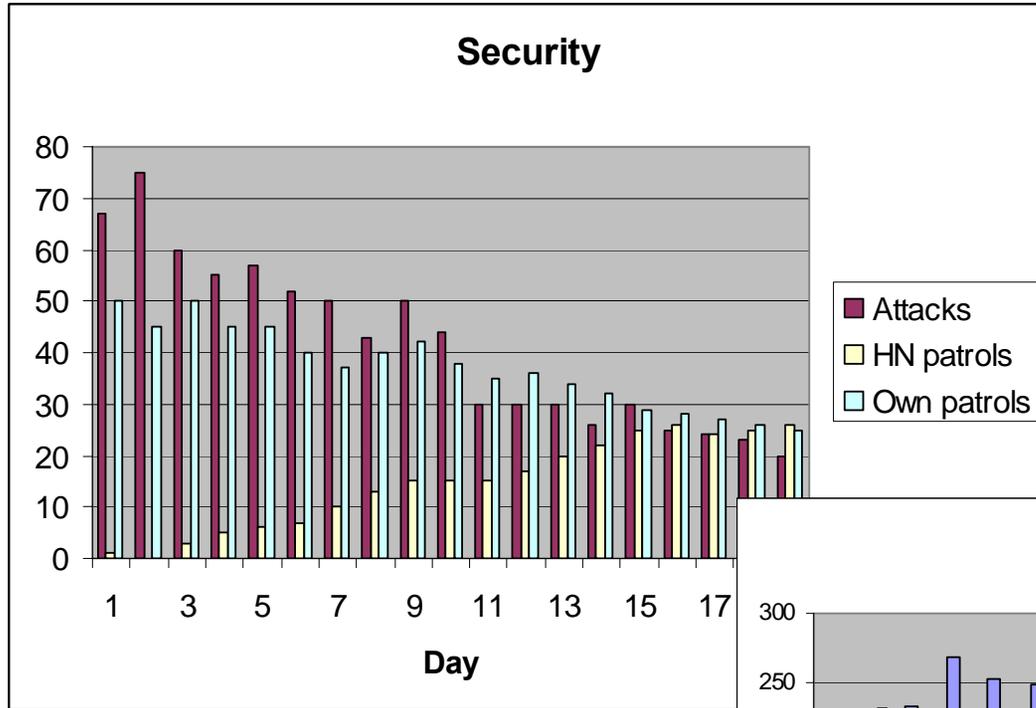




Causality



Security

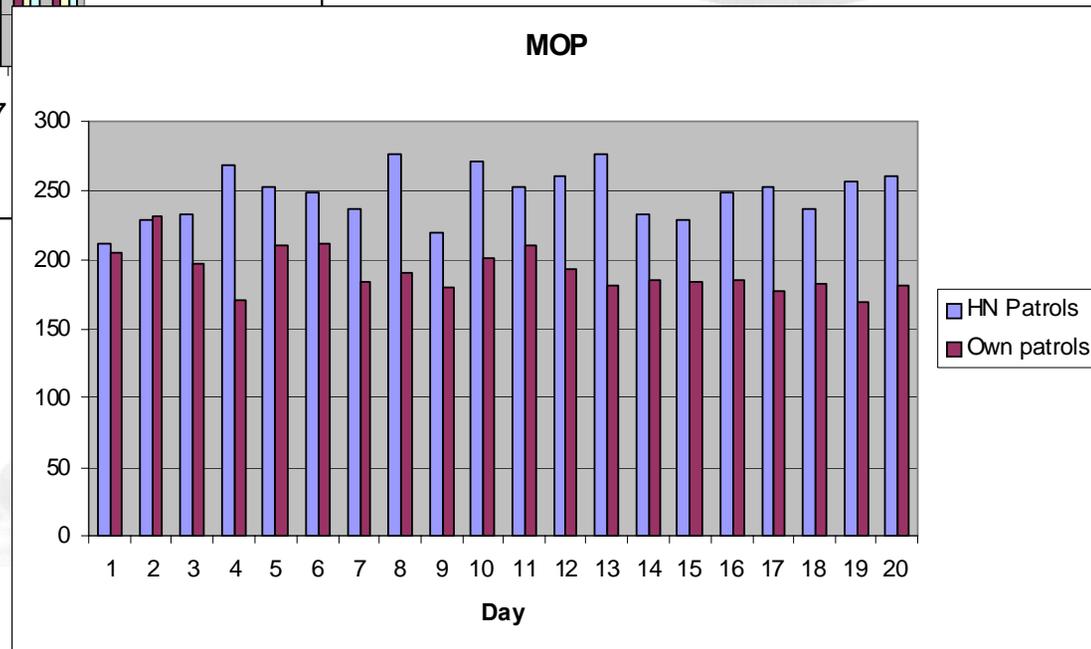


- Conceptual Model
 - Simple / Complex
 - Loose / Tightly Coupled



- “Assessment of Effects and related Actions”

MOP





Methods and Tools



- Statistical Learning and Data Mining
- Time Series
- Agent-Based Models
- Complexity Measures
- Data Collection

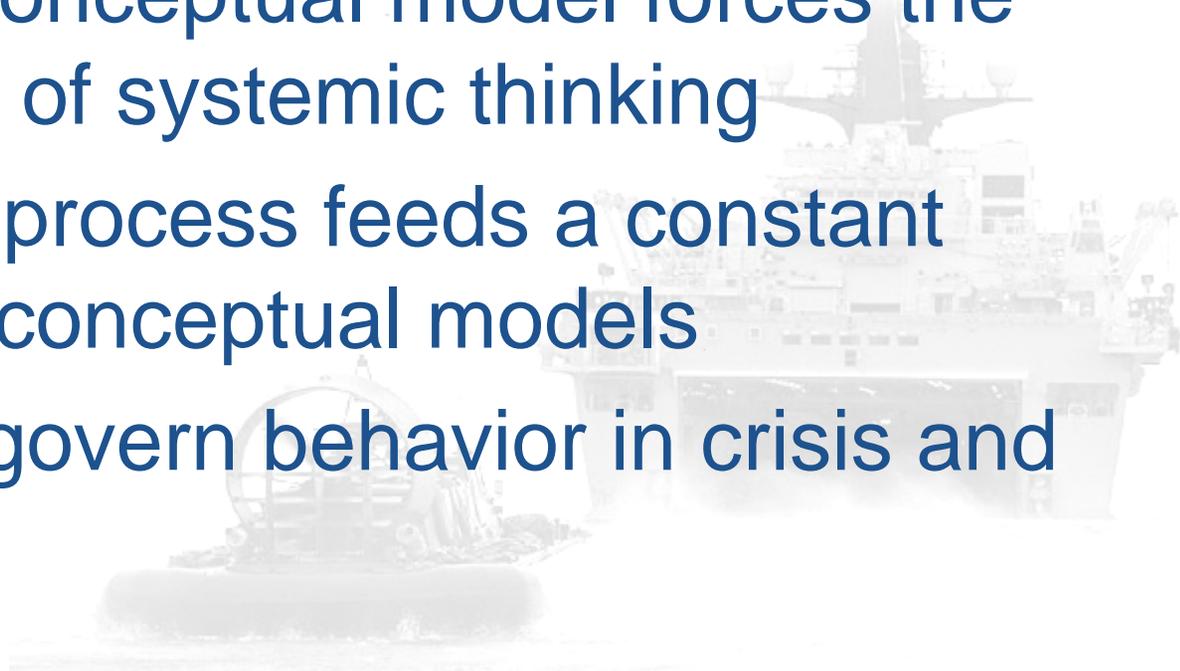




Conclusions and Way Forward



- Progress with methods and tools to analyze complex defense problems
- Creation of conceptual model forces the formalization of systemic thinking
- Assessment process feeds a constant validation of conceptual models
- Models that govern behavior in crisis and conflict





Allied Command Transformation



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