NATO Code of Best Practice (COBP) for C2 Assessment

Overview of the NATO COBP for C2 Assessment

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Agenda

• Context

• NATO COBP
  – Initial Version
  – Revised Version

• Summary
C2 Assessment
(Prior to mid-90’s)

Organizational
• OASD (C3I), et al

People
• NPS C³ Curriculum

Culture
• Quest for the “Holy Grail”

Processes
• New methodologies
  – MCES (MORS)
  – MOA
  – HEAT

Resources
• Increasing

Data
• JDS

R&D
• ONR/MIT Symposia
• CCRP

Tools
• Synthetic Environments
  (e.g., TACCSF)

Products
• Multi-year studies
Initial NATO COBP for C2 Assessment

- **What** -- Develop a Code of Best Practice (COBP) for C2 Assessment for *conventional warfare*, focused on land combat
- **Who**: NATO Panel SAS-002
  - Representatives from 9 countries (NC3A observer)
- **When**
  - NATO Panel was initiated in 1996
  - COBP agreed in Fall 1998
  - Symposium (SAS-039) conducted in Paris (1999)
  - UK Short Form issued in 1999
Initial C2 Assessment Methodology (SAS-002)
C2 Assessment Process: a “Web” vice a Linear Process

- Scenarios
- Organizational Issues
- Problem Formulation
- Output
- Sensitivity/Risk
- MoMs
- Data
- Tools (& Approaches)
Revised NATO COBP for C2 Assessment

• Who -- NATO Panel SAS-026:

- Goal: Extend initial NATO COBP for C2 Assessment to Operations Other Than War (OOTW)
- Objective: Reflect insights derived from two case studies
  - A “relatively” well defined subject -- assessing alternative options for Civil Military Cooperation (CIMIC) facilities for the Stabilization Force (SFOR), Bosnia
  - A broad assessment of C2 to support SFOR

• When
  - Completed Fall 2002
C2 Assessment Process (SAS-026)

Prepare for Success
- Assessment Team
- Other Participants

- Employ multi-disciplinary teams
- Identify key players, establish, and sustain relationships

**Problem**

1. Formulate Problem
2. Problem Formulation

**What**

**How**

1. Select MoM
2. Represent Human/Org Issues
3. Identify Scenarios
4. Identify & Apply Methods and Tools
5. Locate Data
6. Assess Study Risk
7. Plan (Data Collection, Analysis)
8. Study Products

**Study**

**Product**

**Process**

- External Review
Preparing for Success: Participants

• Assemble a multi-disciplinary analysis team tailored to the nature of the problem
  – Core (e.g., project management, OR skills, cross military experience, C4ISR systems, “soft” sciences)
  – Augmentees (e.g., military, training and exercise planning)

• Establish relationships with key participants, *inter alia*,
  – Decisionmakers
  – Stakeholders
  – Peer reviews
  – Providers of assumptions, data
• A social process of developing a shared understanding of what is to be done
• Identify problem segments amenable to analysis and synthesis

C2 Assessment Process (SAS-026)
Problem Formulation: The “What”

- Problem formulation is
  - An *iterative process* that evolves over the course of the study
  - An effort that requires *time and effort* and must precede selection of a methodology or tools

- A *preliminary* formulation of the problem requires an articulation of
  - The “*real*” issues (and an understanding of the decisions to be supported)
  - Assumptions
  - High level MoMs
  - Independent variables
  - Constraints on the values of the variables
  - Time constraints on delivery of advice
C2 Assessment Process (SAS-026)

Sponsor Problem

Prepare for Success
- Assessment Team
- Other Participants

Specify Solution Strategy

Specify how the assessment is performed
- Inherently iterative

How

Problem Formulation

Specify how the assessment is performed
- Inherently iterative

How

What

Formulated Problem

Solution Strategy

External Review

Product

Process

Plan
- Data Collection
- Analysis

Identify & Apply Methods and Tools

Study Risk

Locate Data

Identify Scenarios

Represent Human/Org Issues

Select MoM
Solution Strategy: The “How”

• A solution strategy should strike an artful balance between
  – What the team would like to do, and
  – What is possible to do

given the state of the art, available data, tools, schedule, and resources available

• The solution strategy should be documented in a “Metaplan” (approved and signed by the decisionmaker) that subsumes, inter alia,
  – Analysis plan
  – Data management plan
  – Review plan
  – Security plan
  – Glossary
- No single MoM exists that satisfactorily allows the assessment of C2 performance & effectiveness.
Relationships Among Classes of Measures of Merit

Legend

DP: Dimensional Parameters
MoP: Measures of C2 System Performance
MoE: Measures of C2 System Effectiveness
MoFE: Measures of Force Effectiveness
MoPE: Measures of Policy Effectiveness
C2 Assessment Process (SAS-026)

- The human and organizational dimensions largely distinguish C2 analysis from other military operations analysis.
Taxonomy of Human & Organizational Factors

- **Human Factors**
  - Human behavior (e.g., psycho-physiological; social/cultural)
  - Decisionmaking behavior (e.g., cognitive)
  - Command style

- **Organizational Factors**
  - Structural (e.g., span of control)
  - Functional (e.g., distribution of responsibility/authority)
  - Capacity (e.g., personnel, experience, training)
Multiple scenarios need to be considered and explored for “interesting” regions.
# The Scenario Framework

<table>
<thead>
<tr>
<th>Economic/Political/Military/Social Historic Situation</th>
<th>Mission Constraints &amp; Limitations, ROE</th>
<th>Military Scope Intensity, Joint/Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Security Interests</td>
<td></td>
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</tbody>
</table>

## External Factors

- Organisation, Order of Battle, C2, Doctrine, Resources, Lessons Learned
- Weapons, Logistics, Skills, Morale

## Capabilities of Actors

- Friendly Forces
- Adversary Forces
- Neutrals
- Non-Combatants

- Geography, Region, Terrain, Climate, Weather
- Civil Infrastructure (e.g., Transportation, Telecommunications, Energy)
A mix of tools is required to:
- Compensate for the shortfalls of individual tools
- Represent Blue, Red, & Other information processes
Promising C2 Assessment Tools

• “Soft” Tools
  – Expert elicitation (e.g., Situational Influence Assessment Module (SIAM))
  – Systems dynamics models (e.g., CAPE)
  – Effects based assessment (e.g., Causal Assessment Tool)
  – Agent based models, distillations (e.g., Mana, PAX)

• Constructive M&S
  – Systems-level (e.g., NETWARS)
  – Mission-level (e.g., Joint Conflict and Tactical Simulation (JCATS))
  – Theater-level (e.g., Joint Warfare System (JWARS))
  – Federations (e.g., Pegasus; architecture assessment linking models of combat, communications, and process (e.g., Bonapart))

• Virtual M&S
  – Analysis (e.g., Theater Air C2 Simulation Facility (TACCSF))
  – Acquisition (e.g., Massively multi-player, persistent virtual realities)

• Live M&S
  – Instrumented facility/range (e.g., National Training Center)
“Without data we are nothing.”
Walt Laberge, SIMTECH 97, ergo employ sound data management principles (generate metadata!)
Thoughts on Best Practices for Data

- The analysis team must determine
  - What data are needed in which structure
  - Who owns these data
  - Security issues
  - Costs to buy, collect, or generate data
- In the absence of needed data, it is good practice to use the knowledge of subject matter experts to generate the needed data
- The source of the data, the reliability, and assorted assumptions and constraints must be captured in standardized metadata sets
- Common Data Infrastructure --
  - Adhere to data engineering principles to contribute to data reuse
  - Archive data in retrievable form using standardized metadata sets
• Treat risk and uncertainty explicitly
• Illuminate them for the decisionmaker
There are multiple sources of assessment risk and uncertainty; e.g.,

- Assumptions
- Scenarios
- Data
- Tools (e.g., models)
- Non-linear, possibly chaotic behaviours, arising from dynamic interactions of factors

Risk and uncertainty must be

- Addressed explicitly in an assessment
- Communicated clearly to the decisionmaker
Prepare for Success
- Assessment Team
- Other Participants

Specify Solution Strategy

Select MoM

Represent Human/Org Issues

Identify Scenarios

Identify & Apply Methods and Tools

Locate Data

Assess Study Risk

Plan
- Data Collection
- Analysis

External Review
- Product
- Process

Study Products

- Peer review is essential
- Annotate briefings richly
- Disseminate, archive products
Study Products

• Peer review -- throughout the life of the study!
• Contribute to the efforts of assessment teams to come
  – Archive and make key products available; e.g.,
    • Data
    • Models
    • Supporting scenarios
  – Publish versions that are broadly accessible to the community; e.g.,
    • Command & Control Research & Technology Symposium
    • Military Operations Research Society Symposium
Prepare for Success
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  • Other Participants

A non-linear, iterative process

Formulated Problem

Problem Formulation

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Summary

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How

How

How

What
C2 Problems Tend to be Complex, Poorly Defined

“Vacuums, black holes, antimatter, C2 assessment — It’s the elusive and intangible which appeals to me”