CICS Benchmarking: Bachelor for NEC-era Signals Officers

Tim Grant
Professor, Operational ICT
TJ.Grant@NLDA.nl
Tel: +31 76 527 3261    Mob: +31 638 193 749
Outline

Goal:
• To describe benchmarking of bachelor-level course for Signals, IS, & C2 officers against NEC Maturity Level 4

Overview:
• Introduction & motivation
• Doctrinal background
• NLD Signals, IS, & CIS officers
• Existing course
• Knowledge officers need in NEC-era
• Conclusions & recommendations
Introduction

Netherlands Defence Academy (NLDA):
- Initial officer education:
  All 4 Dutch military services
  Military forming & academic education (Ba. Level)
- Related scientific research

My appointment:
- Professor, Operational ICT & Communications
- Management:
  Team of 7.5 fte lecturers
- Education:
  Bachelors-level course for signals & CIS officer cadets: Communications-, Information-, & C2 Systems (CICS)
- Research:
  6 projects, 5 PhD candidates
  See also Dick Ooms (paper 123) & Gijs vd Heuvel (paper 044)
Motivation

Argument:
• NEC-era officers are now cadets
• They need scientific grounding
• Educators responsible for providing this
• Courses normally based on current insights
• Hence, we must look ahead 5 to 15 years
• NATO NEC Maturity Levels enable this

This paper:
• Shows how NEC likely to affect Training
• Suggests ways to enhance similar courses
Doctrinal background (1)

Recent trends:

- Complex endeavors, eg Iraq, Afghanistan: Defence, diplomacy, & development (“3Ds”)
- Officer as “Thinking Warrior”:
  Making knowledge-intensive decisions under stress
  Develops innovative responses to novel situations
  Same skills as needed for scientific research
  Hence, needs academic education

From Netherlands Defence Doctrine (2005):

- Information operations
- Effects-based operations
- Network Enabled Capabilities (NEC)
Doctrinal background (2)

**NEC value chain:**

- Robustly Networked Force
- Information Sharing
- Quality of Information
- New Processes
- Self Synchronization
- Shared Situational Awareness
- Collaboration
- Cognitive + Social Domains
- Physical Domain
- Mission Effectiveness

Grant: CICS benchmarking - bachelor for NEC-era Signals officers
Doctrinal background (3)

C2 as communication:
• Information sharing …
  Human – human
  Human – machine
• … mediated by information processing

C2 system = Information System (IS):
• Usually technological:
  Information & Communications Technology (ICT)
• but not always …
Doctrinal background (4)

Communication underlies C2

- Observing
- Assessing situation (Orient)
- Event occurring in environment
- Deciding
- Acting
Doctrinal background (5)

Example C2 system
(L-frigate CMS)
Doctrinal background (6)

Another example C2 system *(Uruzghan, Jun 07)*
**Doctrinal background (7)**

**DOTMLPFI factors:**
- Doctrine & ROE
- Organization
- Training & education
- Materiel
- Leadership
- Personnel
- Facilities
- Interoperability

**Three networks:**
- Social
- Knowledge (cognitive)
- Technical

*Van Ettinger, 2008*
Doctrinal background (8)

NML Levels
1. Doctrine
2. Cooperation
3. Coordination
4. Collaborate
5. Coherent

Lines of Development
- Doctrine
- Organization
- Training & Education
- Material (APPLIED TECHNOLOGY)
- Leadership
- Personnel/Culture
- Facilities
- Interoperability

Where we want to be in 2016 (NDD)
Lead & manage activities supporting C2

CICS officer profile:

• As commander:
  Applies IS units, including networks & EW
• As advisor to commander:
  Analysis of commanders’ C2 & IS needs
  Planning & coordinating application of C2 systems, MIS, & IS networks
• In peacetime, preparing C2 & IS support:
  Including selection, development, & maintenance of C2 & IS systems & networks
Competencies:

- **CICS officer has:**
  - Knowledge of current & future operations
  - Insight into C2 & management processes
  - Insight into possibilities for applying ISs
  - Knowledge of capabilities & limitations of ICT
  - Knowledge of IS planning, establishment & control

- **CICS officer is able to:**
  - Develop, configure, deploy, adjust, maintain & secure IS organization
  - Inventarize, analyze, assess & evaluate users’ information needs
  - Realize, combine & synchronize ISs
  - Follow future ICT developments
CICS (1)

1st yr
- iKW
- GOO
- iBW
- iMS
- iOPS

Basic subjects:
- Mathematics
- Physics
- Information technology
- Communications technology

AcVa

2nd yr
- Practicals
- "Ordinary" ICT
  Via OU NL

Military IT applications

3rd yr
- Free choice
  Via OU NL
- Operational Applications
  (info ops, mil data comms, info security, C2 systems, NET)
- Project
CICS (2)

Computing

Operational
- MIT
- BIS

Systems
- SDF
- MDD
- DBS

Technological
- OAO
- VIP
- OAO
- BSY
- IIF

Communications

- CVS
- IOP
- MDS
- ACN
- ACS
- MSC
- CCT
- IBV
- AGE
- ACT
- DTT

Complex numbers
Fourier series

Non-computing subjects:
- Project management

Grant: CICS benchmarking - bachelor for NEC-era Signals officers

Ministry of Defence
Knowledge needed in NEC era (1)

Benchmarking CICS:

• Against “gold standard”:
  Computing Curricula 2005

• Against civil university degrees:
  All Dutch universities
  Information Systems (IS) bachelors

• Against NEC doctrine:
  NATO NEC Maturity Levels (NMLs)
Knowledge needed in NEC era (2)

NATO NEC Maturity Levels:
• Developed by NATO C3 Agency & ACT
• For each NML:
  Checklist by Lines of Development
  Descriptive text
• (Version August 2008)

My procedure:
• Take descriptive text for NML4
• Extract key phrases
• Map to scientific bodies of knowledge & fields
• Identify existing CICS subject (if any)
## Knowledge needed in NEC era (3)

<table>
<thead>
<tr>
<th>LoD</th>
<th>NML 2 – Deconflict</th>
<th>NML 3 – Coordinate</th>
<th>NML 4 – Collaborate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Doctrine</strong></td>
<td>Use of organizational entity doctrine and NATO doctrine deconflicted at the commander level.</td>
<td>Doctrine for combined and joint operations incorporating net enabled capabilities.</td>
<td>Doctrine describes mutual development and execution of a common shared plan.</td>
</tr>
<tr>
<td></td>
<td>National doctrinal development to incorporate NNEC in place but not yet fully implemented.</td>
<td>Level of mutual understanding allows synergy between entities.</td>
<td>Doctrine describes the net enabled planning and execution of operational capabilities driven by a mission based approach to operations.</td>
</tr>
<tr>
<td></td>
<td>NATO doctrine supporting NNEC is being developed but is not yet fully implemented.</td>
<td>Expanded Network interoperability through Info-sec policy.</td>
<td>Doctrine describes &quot;need to share.&quot;</td>
</tr>
<tr>
<td></td>
<td>Doctrine describes &quot;need to know.&quot;</td>
<td>IM doctrine available.</td>
<td>IM doctrine available.</td>
</tr>
<tr>
<td><strong>Organization</strong></td>
<td>Hierarchical structure with a centralized decision making process.</td>
<td>Expand interaction across domains through task groups.</td>
<td>Empowered LNO decision rights is organic to the staff of the supported entity resulting in an integrated staff.</td>
</tr>
<tr>
<td></td>
<td>(Vertical J-staff organization).</td>
<td>LNO empowered by the sending and supporting hosting entities.</td>
<td>Dynamic organization based on mission requirements (including reach back).</td>
</tr>
<tr>
<td></td>
<td>Organizational flexibility limited by structures.</td>
<td>Coordinated national operational logistics chain with multi-national solutions.</td>
<td>Organizational structure allows continuous dynamic interactions (collaboration).</td>
</tr>
<tr>
<td></td>
<td>Organization structure designed to optimize internal processes.</td>
<td>Flexible organization with robust reach back capability.</td>
<td>Organizational structure allows direct external interactions (including other than LNO).</td>
</tr>
<tr>
<td></td>
<td>Indirect external interaction through LNO.</td>
<td>Organizational structure allows deconflicted at the commander level.</td>
<td>IM doctrine available.</td>
</tr>
<tr>
<td></td>
<td>LNO's are an &quot;add on&quot; to the receiving entity.</td>
<td>LNO's used to increase SA and coordination among organizational entities.</td>
<td>LNO supports the sending entity.</td>
</tr>
<tr>
<td></td>
<td>LNO supports deconfliction.</td>
<td>LNO's are an &quot;add on&quot; to the receiving entity.</td>
<td>LNO's are an &quot;add on&quot; to the receiving entity.</td>
</tr>
<tr>
<td><strong>Training</strong></td>
<td>Trains tactics, techniques and procedures (TTP) focusing on capabilities.</td>
<td>Expand interaction across domains through task groups.</td>
<td>Combined joint integrated staff training not excluding NGO.</td>
</tr>
<tr>
<td></td>
<td>Selected elements (commanders and staff) trained for mutual understanding.</td>
<td>LNO empowered by the sending and supporting hosting entities.</td>
<td>Combined joint operational and tactical force training.</td>
</tr>
<tr>
<td></td>
<td>Force training to develop mutual understanding.</td>
<td>Coordinated national operational logistics chain with multi-national solutions.</td>
<td>Trained to work in ad hoc and distributed environments.</td>
</tr>
<tr>
<td></td>
<td>Commander and staff training on joint and combined operations and tactics.</td>
<td>Flexible organization with robust reach back capability.</td>
<td>Combined joint operational and tactical force training.</td>
</tr>
<tr>
<td></td>
<td>(not network enabled) for deconflicted operations.</td>
<td>Organizational structure allows direct external interactions (including other than LNO).</td>
<td>(not excluding NGO).</td>
</tr>
<tr>
<td><strong>Materiel</strong></td>
<td>Utilizes equipment providing military capabilities with limited interoperability and little or no net enabled capability.</td>
<td>Adheres to shared (STANAG) standards.</td>
<td>Implementation of all shared (STANAG) standards.</td>
</tr>
<tr>
<td></td>
<td>Adherence to national or component standards (functional stovepipes).</td>
<td>Systems support shared SA and C2.</td>
<td>C4I Services share information with no human interpretation required.</td>
</tr>
<tr>
<td></td>
<td>Diversity of technical maturity requires national support (some equipment in net enabled but the majority is not).</td>
<td>Systems share data without human intervention with human interpretation of information required.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Systems support shared SA and C2 at the individual unit level with human intervention.</td>
<td>Systems share data without human intervention with human interpretation of information required.</td>
<td></td>
</tr>
<tr>
<td><strong>Leadership</strong></td>
<td>Utilizes methodologies and doctrine focusing on military capabilities for deconfliction.</td>
<td>Manage operations with more extended SA.</td>
<td>Delegation of decision rights supported by technology/infrastructure.</td>
</tr>
<tr>
<td></td>
<td>Leaders focus on complying within agreed deconfliction constraints.</td>
<td>Identity gaps as leadership must be educated on capabilities/organization of other entities.</td>
<td>Leadership adapts decision processes based on situation.</td>
</tr>
<tr>
<td></td>
<td>Communicates vertically within his own organization.</td>
<td>Communicates vertically and peer-to-peer and translates implications internally.</td>
<td>Leaders foster interaction between the partners.</td>
</tr>
<tr>
<td><strong>Personnel</strong></td>
<td>Force recruited and trained to military capabilities for deconfliction.</td>
<td>Cultural / language skills required for bridging diversity of combined organizations.</td>
<td>Integrated staff requires multidisciplinary knowledge.</td>
</tr>
<tr>
<td></td>
<td>Commanders and high level staffs trained in cultural and language skills.</td>
<td>Common command center tailored to the mission with a smaller deployed force (HQ).</td>
<td>Mutually shared and distributed facilities support ad hoc mission tailored organizations.</td>
</tr>
<tr>
<td><strong>Facilities</strong></td>
<td>Component oriented facilities.</td>
<td>Force training to develop mutual understanding.</td>
<td>Facilities provide inter-service support and sustainment.</td>
</tr>
<tr>
<td></td>
<td>Support current state of dedicated functionality.</td>
<td>Commander and staff training on joint and combined operations and tactics.</td>
<td>Facilities provide inter-service support and sustainment.</td>
</tr>
<tr>
<td><strong>Interoperability</strong></td>
<td>LNOs operate to deconflict.</td>
<td>Force training to develop mutual understanding.</td>
<td>LNO supports operational interoperability.</td>
</tr>
<tr>
<td></td>
<td>Technical interoperability (if present) is not architected.</td>
<td>(not network enabled) for deconflicted operations.</td>
<td>Federated network enables technical interoperability.</td>
</tr>
<tr>
<td></td>
<td>Operational interoperability through stovepipes which are limited to functional areas.</td>
<td>Operational interoperability through stovepipes which are limited to functional areas.</td>
<td>Decision rights enable direct interactions between organizational entities.</td>
</tr>
<tr>
<td></td>
<td>Vertical operational and technical interoperability within components.</td>
<td>Vertical operational and technical interoperability within components.</td>
<td>Semantic Interoperability supports shared understanding.</td>
</tr>
</tbody>
</table>
Knowledge needed in NEC era (4)

“NML 4 – Collaborate. This level of maturity is characterized by continued transformational improvements especially in situational awareness and interoperability and adaptive planning and execution. Entities at this maturity level demonstrate collective development and execution of a shared common plan that establishes interdependent relationships. Joint situational awareness is greatly improved as multiple independent sensors at all levels are integrated into a joint COP. A common unified infrastructure based on a single network will allow the seamless sharing of data and facilitate large scale advanced horizontal and vertical interactive collaboration for planning and execution. Major organizational and process changes are evident in this level of maturity because of greatly enhanced information sharing and rich and continuous interactions between entities allowing vertical synchronization through collaboration and planning and horizontal synchronization through shared situational awareness and understanding of intent. A force at this level of maturity can readily adapt to any mission and rapidly plan and synchronize execution of a common intent. Technically, a force at NML 4 uses advanced semantic interoperability as well as integrated registry and discovery services and all user services are accessible through generic portals or workspaces. In general, a force at this level of maturity has completed many aspects of the transformation to a net enabled capability.”
Knowledge needed in NEC era (5)

Refine existing CICS subjects:
- Project management (PM)
- C2 systems (CVS)
- Military Data Systems (MDS)
- Sensor systems & Data Fusion (SDF)
- Net-centric Experience & Theory (NET)
- Information Security (IBV)
- Information Operations (IOP)
- Data Base Systems (DBS)
Knowledge needed in NEC era (6)

Add new CICS subjects:
• Cross-cultural competences
• Human factors & Human-Computer Interface
• Information sharing & collaboration
• Portals & workspaces
• Organizational agility & adaptability
Conclusions

Conclusions:
• Described benchmarking NLDA’s CICS
• Against doctrinal needs for NEC era
• In form of NATO NEC Maturity Levels:
  NML 4 required in 2016

Recommendations:
• Refine 8 subjects
• Add 5 new subjects
• Related further research (see paper)
Any questions?