C2 That!
Command and Control over Post-Industrial Armed Forces

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“It’s Our Mindset, Stupid!”

• Despite much recent lip service to ‘uncertainty’ (FR Livre Blanc, UK Green Paper, US QDR(s), NL Future Policy Survey), the current debate about defence continues to be dominated (and - unnecessarily - restrained) by presentism
  ✓ The current debate is overwhelmingly framed in terms of current ops (Afgh, Iraq,…) , still a bit in terms of the Cold War, and what little is left in terms of industrial-age warfare (Clausewitz, Jomini, etc.)
  ✓ We still primarily think physical technologies and organize in linear, hierarchical structures - we have industrial mindsets

• Need for a new mindset
  ✓ Good chance that defence is on the eve of major changes (fiscal tsunami, backlash against recent ops, value for money debate,…)
  ✓ Essential to develop human pull to collective work and problem solving to exploit the benefits of networks of people, competencies and capabilities.
Going Back to the Roots – ‘Armed Force’

- **arm (2)**
  - “weapon,” 1300, from O.Fr. *armes* (pl.), from L. *arma* ”weapons,” lit. “tools, implements (of war),” from PIE base *ar- ”fit, join.” The notion seems to be “that which is fitted together.” Meaning “heraldic insignia” (in *coat of arms*, etc.) is 1330; originally they were borne on shields of fully armed knights or barons. The verb meaning “to furnish with weapons” is from 1205. *Arms race* first attested 1936.

- **army**
  - c.1386, from O.Fr. *armée*, from M.L. *armata* ”armed force,” from L. *armata*, fem. of *armatus*, pp. of *armare* ”to arm,” lit. “act of arming,” related to *arma* ”tools, arms,” from PIE *ar- ”to fit together.” Originally used of expeditions on sea or land; the specific meaning “land force” first recorded 1786. The O.E. words were *here* (still preserved in derivatives like *harrier*), from PIE *kor- ”people, crowd;” and *fierd*, with an original sense of “expedition,” from *faran ”travel.” In spite of etymology, in the Anglo-Saxon Chronicle, *here* generally meant “invading Vikings” and *fierd* was used for the local militias raised to fight them.
Going Back to the Roots – ‘Command’, ‘Control’

• **command**
  c.1300, from Old French *comander* ”to order, enjoin,” from Vulgar Latin *commandare*, from Latin *commendare* ”to recommend” (see **commend**), alt. by influence of classical Latin *mandare* ”to commit, entrust” (see **mandate**). Replaced Old English *bebeodan*. The noun is attested from 1552. *Commandant* is 1687, from French *Commandment* is c.1280; pronounced as four syllables until 17c. “Of þe x commandements ... þe first comondement is þis, O God we ssul honuri” (c.1280).

• **control**
  c.1310, “to check, verify, regulate,” from Anglo-Norm. *contrroller* ”exert authority,” from M.L. *contrarotulus* ”a counter, register,” from L. *contra-* ”against” (see **contra**) + *rotulus*, dim. of *rota* ”wheel” (see **roll**). From a medieval method of checking accounts by a duplicate register. Sense of “dominate, direct” is c.1450.
Going Back to the Roots – ‘Command’ & ‘Control’

**Command**

‘*Cum*’

*together*

→ ‘softer’, more collegial, consensual (‘*cum*’) association of providing direction: a shared form of mandating based more on elements of ‘commitment’ and ‘trust’ (‘shared intent’) than on ‘top-down’ orders.

**Control**

‘*Contra*’

*against*

→ suggest monitoring the natural course of events that unwind after a course of action has been decided and – where necessary – steering ‘against’ (contra) it on the basis of a perceived discrepancy between what ought to be and what is.

Stephan De Spiegeleire (HCSS) and Peter Essens (TNO), 15th ICCRTS, June 2010
What Do the Roots Tell Us?

• The term ‘command and control’, despite all of the (deserved and undeserved) criticism, has proven remarkably resilient
• The original etymological meanings of ‘command and control’ are much closer to recent thinking (comprehensive approach, systemic operational design, etc.) than we suspect
  ✓ More consensus-building than voluntaristic top-down
  ✓ More based on aligning incentives than on physical coercion
  ✓ More based on the (healthy) dialectical tension between the two, than on their merger in one person (or team)
• If we also look at the ‘reality’ of command and control – the historical story of C2 (e.g. Dupuy e.a.) also shows major changes across epochs
  ➔ rather than looking for new terms, we might want to go back to the original meanings
Epochal Change

Estimated world (pre-1800) and then U.S. Labor Percentages by Sector

‘Armed Force’ as a Reflection of the Age

Nomadic (Hunter/gatherer)  Agrarian society  Industrial society

<table>
<thead>
<tr>
<th>Age</th>
<th>Weapons</th>
<th>Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bare Hands</td>
<td>Human</td>
</tr>
<tr>
<td></td>
<td>Cold</td>
<td>Mechanical</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thermal</td>
</tr>
</tbody>
</table>

Post-industrial society:
Information and knowledge society
# Impact of Epochal Change

<table>
<thead>
<tr>
<th></th>
<th>Pre-industrial</th>
<th>Industrial</th>
<th>Post-industrial</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Actors</strong></td>
<td>Chieftains</td>
<td>‘Princes’ (link x nation states)</td>
<td>States + non-states</td>
</tr>
<tr>
<td><strong>Armed Forces</strong></td>
<td>Ad-hoc forces (no permanent larger than 3000 – v Creveld)</td>
<td>Permanent (industrial) armed forces</td>
<td>?</td>
</tr>
<tr>
<td><strong>Arms’</strong></td>
<td>Bare-handed/Cold</td>
<td>Industrial platforms/Hot</td>
<td>much more diverse (DIME+)</td>
</tr>
<tr>
<td><strong>Organization</strong></td>
<td>Clan</td>
<td>Linear</td>
<td>Network</td>
</tr>
<tr>
<td><strong>Structure</strong></td>
<td>Vertical simple hierarchy</td>
<td>Vertical multi-layered hierarchy</td>
<td>Heterarchy?</td>
</tr>
<tr>
<td><strong>Connectedness</strong></td>
<td>Singular force (all-in-one)</td>
<td>Connected (e.g. CS &amp; CSS)</td>
<td>Distributed?</td>
</tr>
<tr>
<td><strong>Weather</strong></td>
<td>‘Fair-weather’</td>
<td>Year-round 24/7</td>
<td>Pervasive</td>
</tr>
<tr>
<td><strong>Domain</strong></td>
<td>Mostly land, some sea</td>
<td>Land-Air-Sea</td>
<td>Multi-domain (space, cyber)</td>
</tr>
<tr>
<td><strong>Effects through</strong></td>
<td>Concentration</td>
<td>Mass (economies of scale)</td>
<td>Network (economies)</td>
</tr>
<tr>
<td><strong>Level</strong></td>
<td>Tactical</td>
<td>Operational(/strategic)</td>
<td>Fused</td>
</tr>
<tr>
<td><strong>Projection</strong></td>
<td>Local</td>
<td>Line-of-sight</td>
<td>Global</td>
</tr>
<tr>
<td><strong>Mode</strong></td>
<td>Hit-and-run / Siege</td>
<td>Linear Attrition &amp; Manoeuvre</td>
<td>Network?</td>
</tr>
<tr>
<td><strong>Specialization</strong></td>
<td>All-in-one</td>
<td>Advanced role specialization</td>
<td>Network</td>
</tr>
<tr>
<td><strong>Time of ‘battle’</strong></td>
<td>Punctuated</td>
<td>Punctuated</td>
<td>Pervasive</td>
</tr>
<tr>
<td><strong>Leadership</strong></td>
<td>Heroic leadership</td>
<td>Increasingly sophisticated C2</td>
<td>Network</td>
</tr>
<tr>
<td><strong>Planning</strong></td>
<td>Rudimentary planning</td>
<td>Deliberate purposive planning</td>
<td>Adaptive planning</td>
</tr>
</tbody>
</table>
(Kondratieff/Schumpeter/) Perez Technology Revolution Cycle

INSTALLATION PERIOD

DEPLOYMENT PERIOD

Turning Point

MATURITY

Financial Search

Crash Institutional Re-composition

SYNERGY

Production Surge

Next big-bang

Previous Great Surge

Financial Revolution

Big-bang

FRENZY

Bubble economy

Next Great Surge

Degree of diffusion of the technological revolution

Time
(Kondratieff/Schumpeter/)Perez

<table>
<thead>
<tr>
<th>Technological revolution</th>
<th>INSTALLATION</th>
<th>DEPLOYMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core Country</td>
<td>IRRUPTION</td>
<td>SYNERGY</td>
</tr>
<tr>
<td>The Industrial Revolution</td>
<td></td>
<td>1810</td>
</tr>
<tr>
<td>Britain</td>
<td></td>
<td>1825</td>
</tr>
<tr>
<td>Age of Steam and railways</td>
<td>1829</td>
<td>1857</td>
</tr>
<tr>
<td>Britain (spreading to continent and USA)</td>
<td>Railway mania</td>
<td>1866</td>
</tr>
<tr>
<td>Age of Steel, Electricity and Heavy Engineering</td>
<td>1875</td>
<td>1873</td>
</tr>
<tr>
<td>USA and Germany overtaking Britain</td>
<td>Canal Mania</td>
<td>1903</td>
</tr>
<tr>
<td>Age of Oil, Automobiles and Mass Production</td>
<td>Panic 1797</td>
<td>US</td>
</tr>
<tr>
<td>USA (spreading to Europe)</td>
<td></td>
<td>‘Rich man’s panic’</td>
</tr>
<tr>
<td>Age of Information and Telecommunications</td>
<td>1908</td>
<td>1907</td>
</tr>
<tr>
<td>USA (spreading to Europe)</td>
<td>Railway mania</td>
<td>1907</td>
</tr>
<tr>
<td>Age of Information and Telecommunications</td>
<td>1971</td>
<td>1960</td>
</tr>
<tr>
<td>USA (spreading to Europe and Asia)</td>
<td>“Oil Crises”</td>
<td>1974*</td>
</tr>
</tbody>
</table>

**Turning Point**

- 1797
- 1847
- 1893
- 1929
- 1974

**Other Key Events**

- 1819 Panic US
- 1848 Revolutions
- 1903 US
- 1925 Crash
- 1987 Big-bang
- 2000 NASDAQ

**Biotechnology**

- 1974 Bio – nano?
Post-industrial C2?

Focus on 3 changes:

• The changes in the nature of the armed forces themselves (and what they mean for C2);
• Changes in the role armed forces will play in emerging security ecosystems (and what they mean for C2); and
• The extent to which the ‘command’ and the ‘control’ functions may have to be
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A Universe of Modular Business Services Allows Even Small Businesses and Start-ups to Become Globally Integrated
C2 That!
The Alberts and Hayes C2 Cube
The TNO Interdependence Cube

1. You are also highly dependent upon the other party for reaching your goal
2. The other party is equally dependent on you for reaching its’ goals
3. Your goals and the other parties’ goals are corresponding

1. You are highly dependent upon another party for certain resources
2. The other party needs these same resources too
3. The other party does not depend on you for resources

1. You have to interact to some extent with the other party to perform you mission
2. This is not conflicting with the activities of the other party
3. The other party also needs to interact with you to perform its’ mission
C2 That!

- Firm-centric
- Vertical Integration
- Ownership

- Network-centric
- Virtual Integration
- Relationships

Source: “Strategy 2.0: Winning in a Network Era”
Professor N. Venkatraman, Boston University, May 2007
Uncoupling Command and Control?
Main takeaways (1/2)

- **Epochs matter** enormously to both armed forces and to C2 systems – in ways that cannot be fully anticipated.
- ‘Armed forces’ (/C2) today may look as different from their future instantiations as from their stone-age counterparts.
- The (forgotten) etymological roots of command and control may be of some assistance in navigating the transition from an industrial to a post-industrial age. They suggest:
  - a more consensual (‘cum-mandare’) and less directive form of command.
  - a different view of control – more in line with the way control is conceived in other areas of public and private life (‘contrarotulus’).
- The broadening of the role of diverse partners in missions and the (societal) need for independent views on progress brings forward the requirement that the functions of **command and control** may once again have to be segregated from each other – as they are in many other walks of life.
Main takeaways (2/2)

• **from NEC 1.0** (using the physical technologies of the ICT-revolution to obtain desired security effects by enabling the same organization to do the same things better, faster, cheaper,…)

• **to NEC 2.0** (developing and applying new social technologies to obtain desired security effects by having transformed defense organizations do different things in a network (ecosystem) with other security-providers):
  - **Internally**, future armed forces may prove to be much more ‘modular’ and ‘loosely coupled’ than today’s. This means command and control will have to adapt to this, and will have to find different ways to maintain collective alignment and commitment.
  - **Externally**, future armed forces may have to behave less like ‘stars’ and more like ‘galaxies’ with a wide variety of value chain partners that will not be subordinate to (and hence ‘controllable’ by) the defence organization. Exercising command and control over such a ‘galaxy’ will undoubtedly require other mechanisms – more likely to be based on relationships and contracts than on ‘commands’ as currently understood.