



TTCP and CD&E

Rod Schmitke

**NATO Symposium on
*Analytical Support to Defence Transformation***

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Report Documentation Page

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Outline of Presentation

- TTCP Basics
- The TTCP NCW Enterprise
 - Vision – Key Outcomes
 - Program
- Workshop on TTCP Linkages to CD&E
 - Objectives, Participants, Program
 - Observations
 - Recommendations



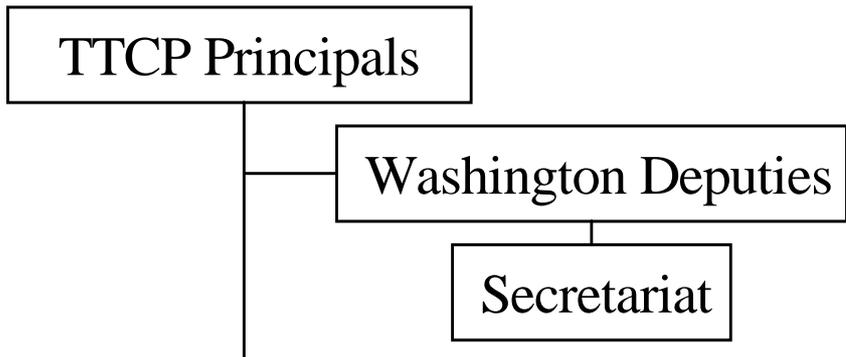
TTCP Basics - Nations

- TTCP is the acronym for **The Technical Cooperation Program**. Five nations are in TTCP: Australia, Canada, New Zealand, United Kingdom and United States.
- The origin of TTCP was the US-UK Declaration of Common Purpose in 1957.
- CA joined immediately afterward. The name was the **Tripartite Technical Cooperation Program (TTCP)**.
- AU joined in 1965 and NZ in 1969. The name became **The Technical Cooperation Program**, with the same acronym.

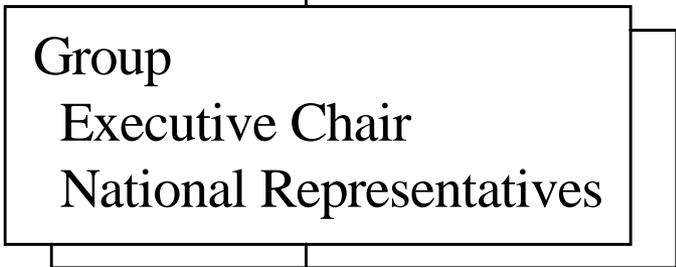


TTCP Basics - Structure

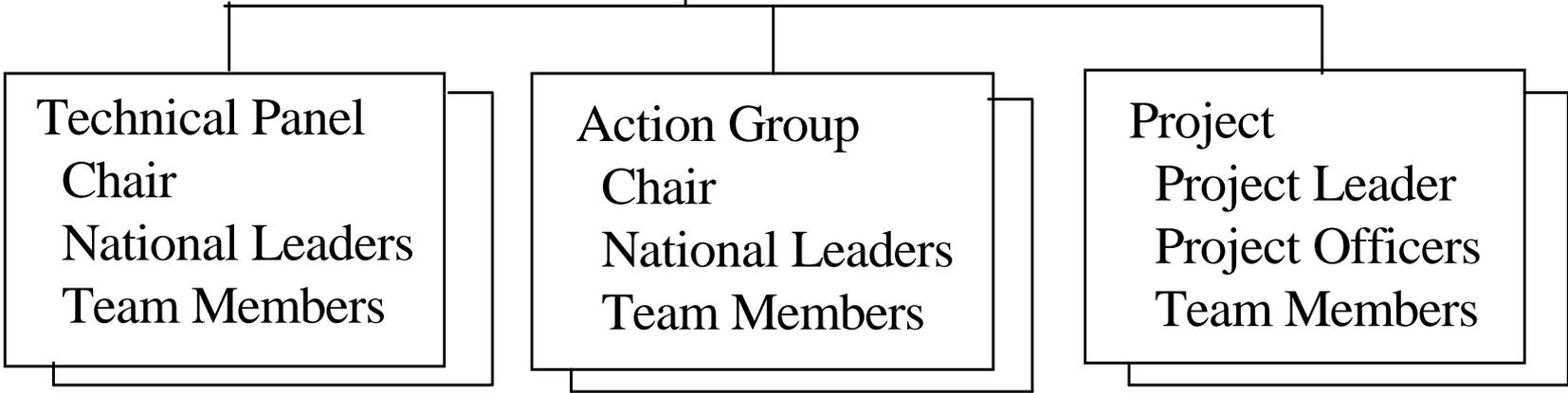
Level 1



Level 2



Level 3





TTCP Basics - Groups

AER - Aerospace Systems

C3I - Command, Control, Comms and Information Systems

CBD - Chemical, Biological and Radiological Defence

EWS - Electronic Warfare Systems

HUM - Human Resources and Performance

JSA - Joint Systems and Analysis

MAR - Maritime Systems

MAT - Materials and Processes Technology

SEN - Sensors

WPN - Conventional Weapons Technology



The TTCP NCW Enterprise

- Lots of activity on NCW in TTCP over the past two years, resulting in “The TTCP NCW Enterprise”, approved by the Principals in Oct 04.

Vision

Key Outcomes

Program

Physical	Information	Cognitive	Social	Cross-Cutting
<i>Sensing</i>	<i>Decision Support</i>	<i>Cognitive Processes</i>	<i>Social Processes</i>	<i>Fundamentals & Architectures</i>
<i>Sensor System Issues</i>	<i>Information Processing</i>	<i>Human-Machine Inter</i>	<i>Enablers</i>	<i>Planning, Acq & Sustainment</i>
<i>Tracking & Analyzing</i>	<i>Information Management</i>	<i>Command Issues</i>		<i>Experimentation, M&S</i>
<i>Comms Technology</i>				
<i>Comms System Protection</i>				
<i>Weapons & WMD</i>				



Vision & Key Outcomes

We envision that the future forces of the TTCP nations will fully exploit Network Enabled Capabilities to achieve rapid battlefield dominance in coalition operations. The aim of the TTCP NCW R&D Program is that these forces will achieve the following capabilities:

- *Superior, shared situational awareness*
- *Survivable, robust and efficient network connectivity*
- *Dynamic, robust, fused sensor grids employing a wide range of technologies*
- *Swift and successful decision-making processes at all levels*
- *Precision effects achieved through synchronization of effort*
- *Rapid direction of military resources and high operational tempo*

We also envisage the TTCP NCW Program will:

- *Lead to strong links between the S&T and CD&E communities of the TTCP nations and bring scientific rigour to the application of CD&E to NCW.*
- *Support the design and acquisition of NCW systems.*



NCW Program – 73 R&D Topics

- **Physical & Information Domains**

Most of the R&D Topics fall in these two Domains, contributing to:

- *Superior, shared situational awareness*
- *Survivable, robust and efficient network connectivity*
- *Dynamic, robust, fused sensor grids employing a wide range of technologies*

- **Cognitive & Social Domains**

The thrust in these Domains is toward:

- *Swift and successful decision-making processes*
- *Rapid direction of military resources and high operational tempo*

- **Cross-Cutting Domain**

Work in this Domain will provide or support:

- *Strong links between the S&T and CD&E communities of the TTCP nations.*
- *Scientific rigour to the application of CD&E to NCW.*
- *Design and acquisition of NCW systems*



Key Gaps

Critical Gaps in Cognitive Domain

- Gaps stem from fundamental shortfalls in the S&T programs of the TTCP nations. Critical gaps include:
 - In Decision Making, the scientific underpinnings of cognitive processes and the effect on situational understanding, sense-making. Decision-making under uncertainty in military operations.
 - In Command Issues, understanding the NCW impact on coalition C2 functions.

Critical Gaps in Social Domain

- Critical gaps include: distributed decision-making, development of shared awareness, collaboration and synchronization, impact of national cultural differences on risk acceptance and tolerance of uncertainty, behaviour of distributed teams, coalition semantic interoperability, training tools for coalition NCW operations.



NCW R&D Topics - Examples

Information Domain

Information tailoring tools to allow smart, adaptive data pull and useful data fusion for all combatants

Cognitive Domain

Understanding the cognitive processes critical to military decision-making, for example sense-making

The changes that NCW will make to both national and coalition command and control functions

Social Domain

Social and cognitive aspects of distributed decision-making

Training and exercises for national and coalition NCW operations

Cross-Cutting Domain

Multinational NCW experimentation



Workshop on TTCP Linkages to the CD&E Community

- The NCW initiative highlighted that experimentation is essential for the advancement of networked capabilities. Also, there must be a strong link between NCW R&D and Concept Development.
- The Workshop addressed the broad issue of TTCP's role in providing scientific, technical and analytical support to national and international CD&E, with particular emphasis on experimentation related to the development and implementation of NCW systems and processes.



Key Dimensions of Links Between S&T and CD&E

1. How the S&T community can help inform the CD&E community on how best to conduct warfighting experimentation.
2. How S&T can be positioned to:
 - inform CD&E during the concept development phase
 - contribute to the actual experimentation to validate these concepts, for example when new technology is brought to the experiment.
3. How experimentation can inform and advance S&T, especially in the context of NCW.



The Big Questions

- With which CD&E organizations should TTCP establish linkages?
- What form should these linkages take?
- How should TTCP teams participate in CD&E?
- What structure should TTCP put in place to facilitate participation in CD&E?



Participants

- Forty-seven people participated: 6 from Australia, 12 from Canada, 1 from New Zealand, 5 from UK, 20 from US, and 3 from NATO Allied Command Transformation (ACT).
- TTCP attendance included the NCW Strategic Integration Team and additional representatives from the Groups.
- The CD&E communities of the TTCP nations were well represented, as was CD&E in NATO ACT.



Program Overview

Day 1 – Set the Scene

- CD&E Perspectives – AU, CA, UK, US Army, USN, USAF, JFCOM, NATO ACT
- Closely Related Work – TTCP NCW Enterprise, GUIDEx, ABCA CD&E Handbook, Net Centric Ops Case Studies

Day 2 – Serious Work

- Breakout and Plenary Sessions to examine the issues and questions posed in previous slides

Day 3 – More Serious Work

- Final Breakout and Plenary Sessions



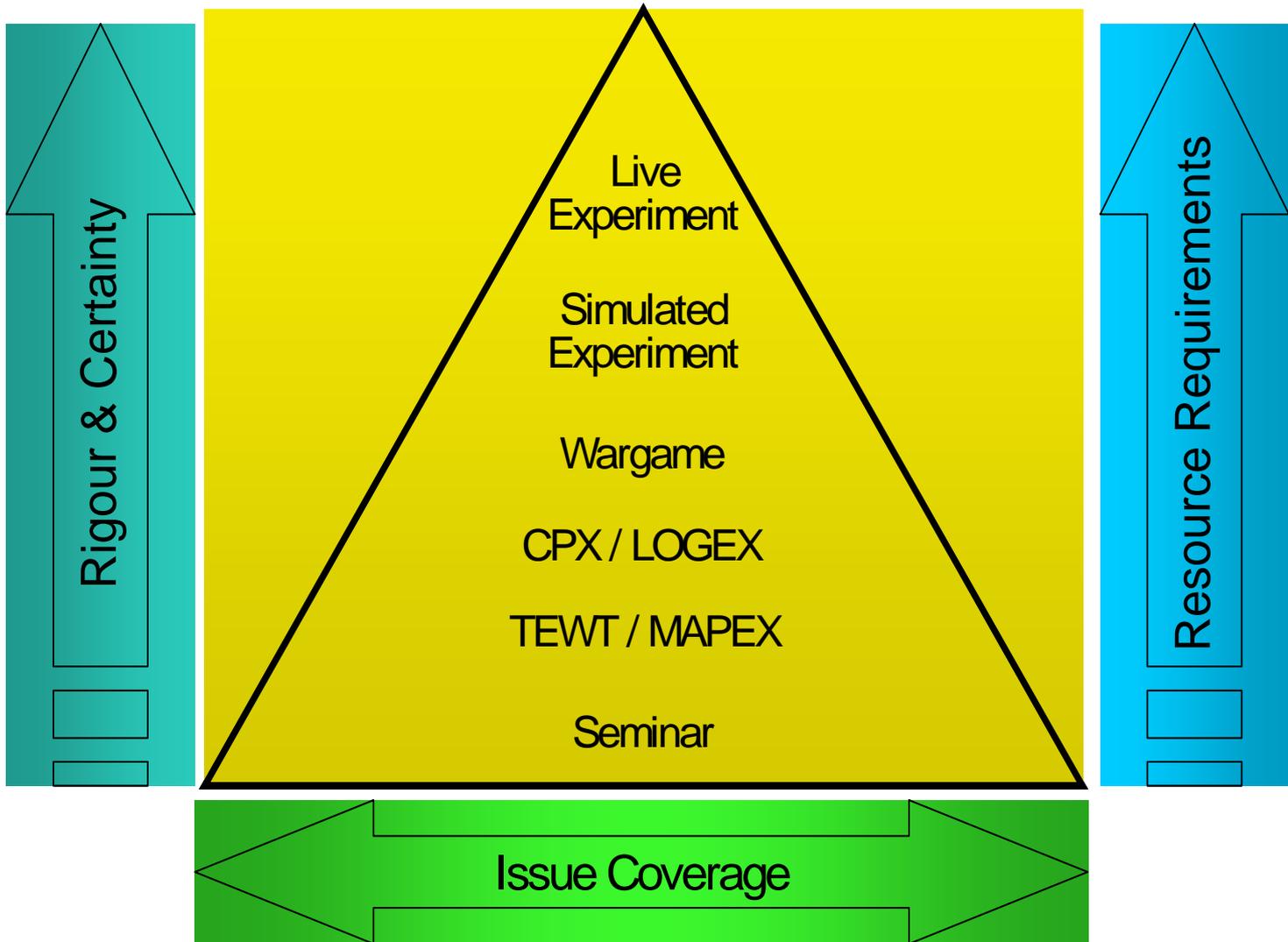
Examples

- The next 14 slides are extracted from the AU, CA, UK, JFCOM, US Army, and NATO ACT presentations, just to give you a very brief glimpse of the sort of material presented on Day 1.
- We have put all the slide decks on a CD. Contact me if you'd like a copy.

rod.schmitke@international.gc.ca

Australia - Components of Land Force Experimentation

- Army Experimentation Facility
 - Seminar and Constructive Wargaming
 - Simulated Experiments
 - Explores Warfighting Concepts
 - Force Structure Constructs
 - Experimentation Tools
- Task Force Simulation and Experimentation Centre
 - Analysis & Experimentation Tool Development
 - Data Management
 - Terrain Analysis
 - Constructive Simulation
 - Operations Analysis
 - Modeling Development (Urban/Complex)



Current Activities

- Force Protection Vessel in Confined Waters (Jan –Jun 05)
- Mini UAV (Jan 05 – Jun 06)
 - Define and refine CFMWC experimentation process

Planned Activities (under review)

- Force Protection
- Net Centric Warfare
- Anti-Submarine Warfare
- Torpedo Countermeasures
- Littoral Operations
- Imagery
- Electronic Warfare

Land Force CD&E Activities

Current Activities

- “Interim Army” Force Employment (Feb ’04 – Jun ’05)
 - Determine structures and equipment for *circa* 2009
- Command and Control Trials (Jan ’04 – Dec ’05)
 - Guide fielding of digital C2 at brigade and unit level

Planned Activities

- “Army of Tomorrow” Force Employment (ongoing)
 - Determine structures and equipment for *circa* 2010-2015
- “Direct Fire Systems” Employment (Jan ’04 to Dec ’06)
 - Guide introduction of direct-fire systems: LAV Gen III, Mobile Gun System, Multi-Mission Effects Vehicle, TOW on LAV

UK - Defence Experimentation Centre

Requirements

**Customer Interface
Future Requirement
Intervention Mgmt
International Liaison
Military Advice**

Analysis

**Investigation of
Problem Space
Experimental
Design
Visualisation**

Operations

**Major
Experimentation
Themes**

Assurance

**Policy
Best Practice
Accreditation
Battlespace context**

Facilities

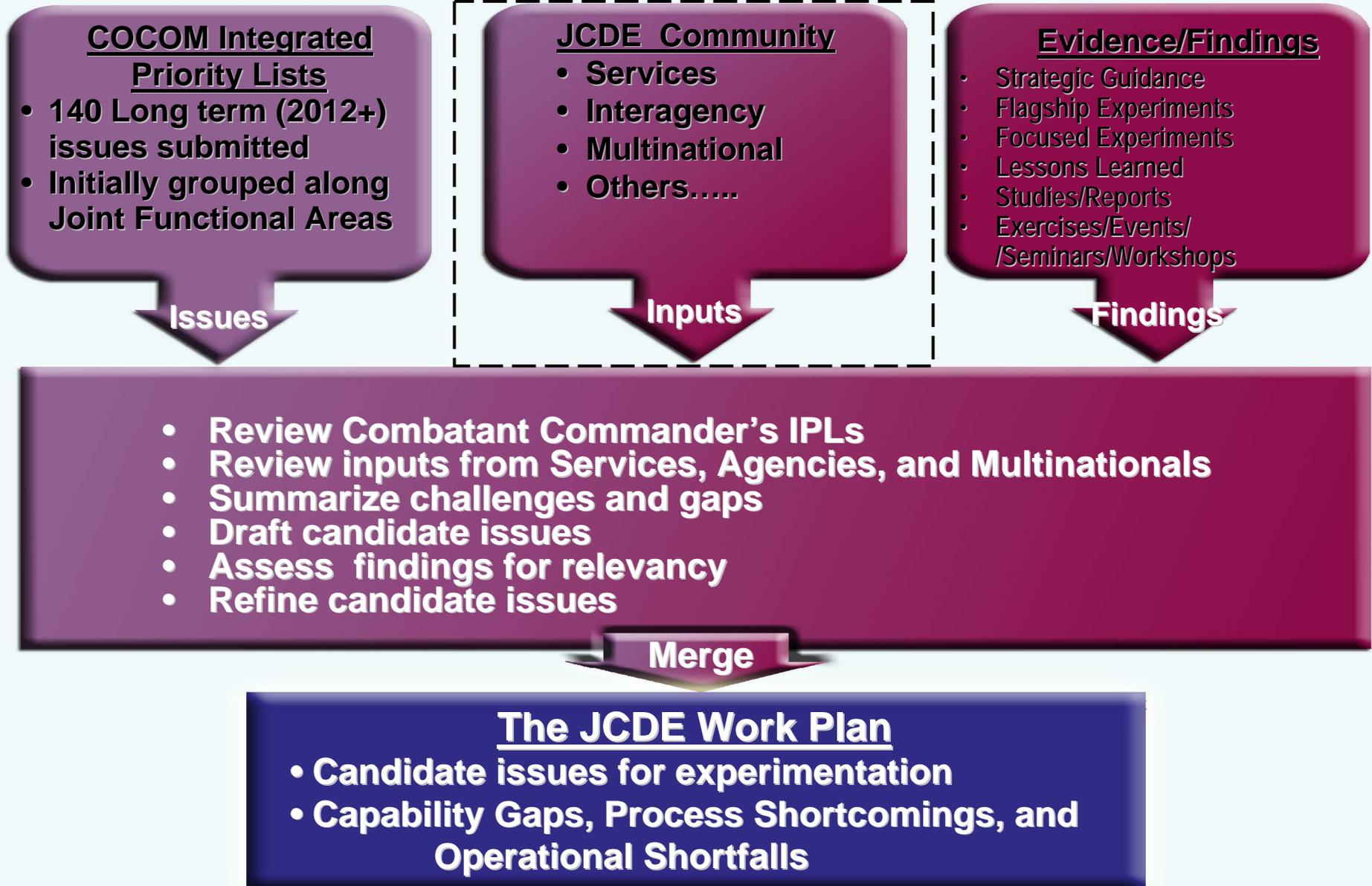
**Hub Facility
Federation
Technical Standards
Model Development**

UK - Experiments in Progress

- CBM(L) – G4 Op Planning
- LTP 05 – Managing tactical info in RLP
- ISTAR 2 – Collection Co-ordination
- Logistics C2 – Logs Component Cmd
- C2 of the Underwater Battlespace
- Effects Based Operations
- Battlespace Management
- Medium Weight – C2/ISTAR Integration

JFCOM - Developing the Integrated FY06 Work Plan

- New Approach



Joint Experimentation (FY 05 and Beyond)

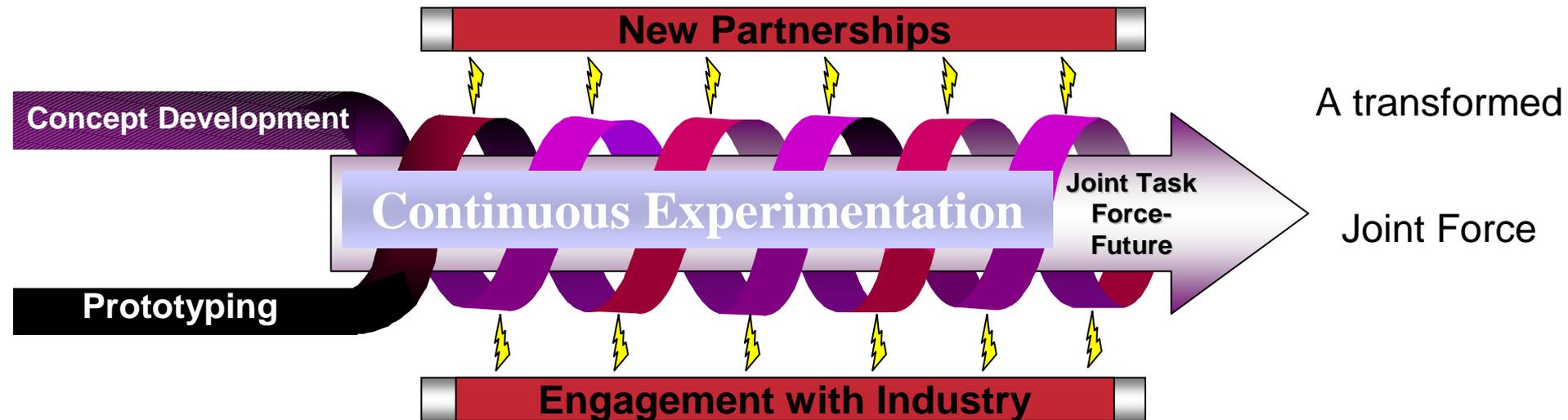
JE Partnerships

- Broaden Collaboration
- Publish Interests and Activities
- Produce New JE Campaign
- Develop/Refine JE Work Plan
- Share Expertise and Tools



To Achieve

- Shorter Development Cycles
- Rapid Prototypes to Warfighter
- Improved Resource Efficiency
- Visibility Across DoD Body of Knowledge
- Aligned Effort toward Transformation Objectives
- Increased Credibility in Recommendations



Concept Development and Prototyping Opportunities concentrate effort, through Continuous Experimentation, to leverage the intellectual resources of partners toward near term solution and shaping of future warfighting capability.

US Army Battle Labs

Army Battle Lab

TRADOC Battle Lab

Battle Command Battle Lab – Leavenworth –

BCBL-L (FT Leavenworth)
COL Polcynski

Maneuver Support Battle Lab

MSBL (FT Leonard Wood)
COL Hornack

**Unit of Action Maneuver
Battle Lab**

UAMBL (FT Knox)
BG Bryant / Mr. Hughes

**Space & Missile Defense
Battle Lab**

SMDBL (Colo. Springs, CO / Huntsville, AL)
Mr. Burger

**Combat Service Support
Battle Lab**

CSSBL (FT Lee)
COL Mullins

**Battle Command Battle Lab –
Huachuca**

BCBL-H (FT Huachuca)
Mr. Denno

**Army Special Operations
Battle Lab**

ARSOBL (FT Bragg)
Mr. Basehart

**Air & Missile Defense
Battle Lab**

AMDBL (FT Bliss)
COL McGuire

Battle Command Battle Lab – Gordon

BCBL-G (FT Gordon)
COL Dunn

**Depth & Simultaneous Attack
Battle Lab**

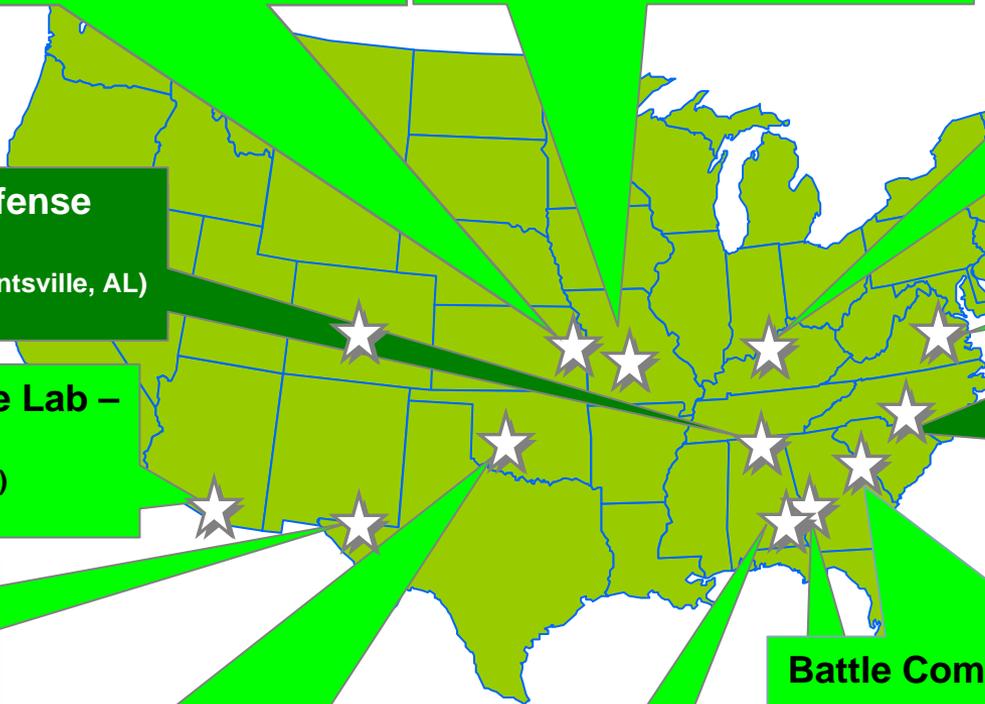
DSABL (FT Sill)
Mr. Durham

**Air Maneuver
Battle Lab**

AMBL (FT Rucker)
Col Johnson

Soldier Battle Lab

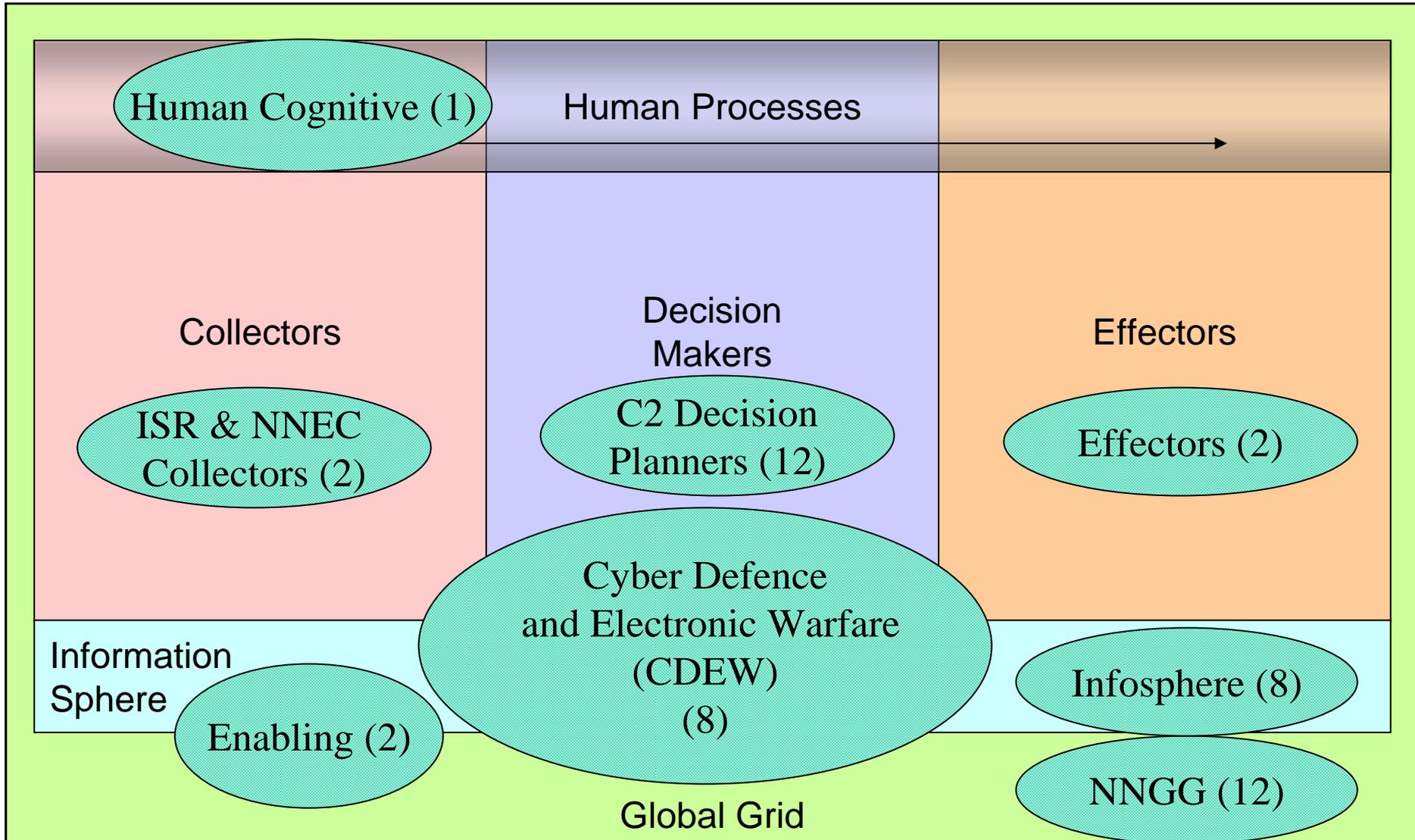
SBL (FT Benning)
COL Burns



US Army - Campaign Objectives

- ACP 6-1: Enhance Current Force capabilities by spiraling forward proven future capabilities with high payoff potential into the Current Force.
- ACP 6-2: Generate First FCS-equipped UA commencing NLT FY 07 and attaining operational capability CY14.
- ACP 6-3: Coordinate and synchronize Army CD&E and S&T development with parallel Joint processes.
- ACP 6-4: Develop the following joint interdependent capabilities: Joint Fires, Joint Battle Command (including Joint Intelligence), Joint Force Protection, Joint A&MD, and Joint Logistics.
- ACP 6-5: Develop the concepts and doctrine to guide force development of the Future Force.
- ACP 6-6: Achieve Army strategic mobility objectives and initiate solution strategies for inter-theater and intra-theater mobility requirements to support the combatant commander's land force mobility requirements and support DoD's joint swiftness goals and conflict separation objectives.
- ACP 6-7: Develop operating force Network Architecture and resource plan for the Army's portion of the Global Information Grid.

NNEC Conceptual Framework, Overlaid with 2005 IS & NNEC Experiments



(#) denotes number of experiments within this category

Breakout of Experiments by Sub-Category

C2 Decision Planning (12):

- Advanced Intelligence Analysis Tools in Support of Counter-terrorism and Force Protection
- LC2IS
- Joint C2 Coordination Tools
- Friendly Force Tracking (FFT) Sit Awareness Experimentation
- Coalition Combat Identification (CCID)
- TIDE REP/COP (Recognized Environmental Picture) / Common Op Picture
- Rapid Environmental Assessment (REA) in Support of the REP
- Future Common Operational Picture (COP) Services
- Intelligence Data from BICC Provided as Web Services for TIDE
- Advanced Visualisation for Future Commanders
- Integrated Logistics *
- Force Planning and Deployment Tracking Systems *



Key Observations – General

- CD&E is a “growth industry” in the TTCP nations and NATO. The importance of experimentation in both concept and capability development is well recognized, and there are excellent experimentation programs and campaign plans. However, international linkages in CD&E are in their infancy, with a few notable exceptions, such as NATO ACT-JFCOM and ABCA.
- TTCP Nations have or are establishing S&T and OR / OA capabilities in their CD&E organizations. For example, in Canada the Canadian Forces Experimentation Centre (CFEC) has embedded S&T and OR staff, and CFEC is reasonably well integrated with Defence R&D Canada.
- Planning of S&T programs/projects is not synchronized with CD&E planning, either nationally or internationally. This problem must be solved nationally first.



Key Observations – What can S&T do for CD&E?

S&T can provide OR/OA tools and skills, scientific advice and technology options. S&T can inform on the processes for: problem definition; experimental design, conduct, data capture and analysis; understanding lessons learned from operations; and technology prototyping. Technology push is important in concept development.

TTCP can be an instrument for bringing the S&T/OR and CD&E communities closer together. Examples include:

- Create an international forum for scientists and analysts working in CD&E. This forum would be an important social network and could sponsor conferences and workshops to provide venues for problem definition-solving, sharing current practice, etc.
- Foster a scientific and analytical approach to experimentation, including best practice, international standards and measures.
- Address CD&E linkages in a broader science policy context, e.g. Technology Outlook.



Key Observations - How can experimentation advance S&T?

- Experimentation provides an opportunity to “integrate” systems and concepts. It can be used to assess and validate S&T program direction. It provides insight into current and future capabilities.
- Experimentation supports operational and technical risk reduction. Key element in the spiral development process.
- Experimentation allows examination of human and organizational issues.
- The S&T community needs a better understanding of the operator domain and better access to real warfighters.
- There is a need to generate operator pull from S&T. Early experimentation at the S&T level is necessary to demonstrate capabilities to operators.
- Mechanisms are needed for incremental integration of functionality into operational systems.



Key Observations - Risks

Currently, CD&E is very operationally based, with limited S&T access. Experiments tend to be large and expensive, with low risk in terms of the concepts being explored. Failures tend not to be reviewed or followed-up.

There are risks associated with CD&E. For example:

- Resources and time are generally insufficient to enable comprehensive coverage of all scenarios (e.g. technology options, asymmetric tactics, variable capabilities of Red Forces) and rigorous testing of all hypotheses.
- Over reliance on CD&E as the only force development tool may lead to lack of comprehensive evaluation, early termination of concepts, incomplete understanding of technical risk, and insufficient vulnerability and sensitivity analysis.



Key Observations – NCW and Experimentation

- Transition and scaling from laboratory test-beds to real platforms may be difficult.
- Building the network may be easier to achieve than willingness to use it.
- Networking must be robust, and the network must build trust.
- NCW experimentation must include studies of processes, organizations and leadership dynamics.
- Knowledge Management (KM) is critical – the right information to the right decision-maker at the right time. KM must accommodate different leadership styles and cultural issues, especially in coalitions.
- Modelling and simulation may be employed in many ways: to design and support experiments; to analyze alternatives in concept development; and for enhanced rehearsal by the deployed commander.



Key Observations – Linking TTCP to CD&E

- Nationally, there is good progress on forging links between the S&T/OR and CD&E communities in Australia, Canada and the UK. In the US, the Services and JFCOM all have strong experimentation programs, which are well connected to the Service laboratories.
- On the international scene, the most notable players in CD&E are JFCOM and NATO ACT. Others include: ABCA Armies, AUSCANZUKUS Naval C4I, Multilateral Interoperability Council (MIC), and Multilateral Interoperability Program (MIP).
- JSA and MAR Groups have been successful in embedding OR/OA in their Panels and Action Groups. MAR's Panel 1 on *Maritime Command, Control and Information Management* has a strong experimentation program. Another excellent example of experimentation in TTCP is SEN AG-7 *Maritime Sensor Integration Experiment*.



Recommendations

1. Create CD&E Forum. Details on next slide.
2. Encourage Groups to establish CD&E elements in those Panels and Action Groups that will be heavily involved in the TTCP NCW Enterprise.
3. Connect TTCP to the key CD&E organizations by drawing membership for the CD&E Forum and CD&E Elements in TTCP Groups, Panels and Action Groups from the S&T/OR staff embedded in the CD&E organizations of the TTCP nations.
4. Focus on strengthening TTCP's relationship with the CD&E components of JFCOM and ACT.



CD&E Forum or TP

- Mission will be to:
 - Provide a social and professional network for scientists and analysts working in CD&E.
 - Provide a high-visibility link between TTCP and national and international CD&E organizations.
 - Provide a central view of and advocacy for experimentation in TTCP.
- Draw membership from the S&T/OR/OA staff embedded in the CD&E organizations of the TTCP nations. Vital to include representation from JFCOM.
- Professional enrichment activities would include conferences and workshops that provide opportunities to share experiences and practices, share lessons learned, discuss and develop plans for experiments and campaigns, solve problems, develop tools and techniques, and develop guidance for experimentation.

TTCP and CD&E

Rod Schmitke
Councillor Defence R & D
Embassy of Canada
501 Pennsylvania Ave NW
Washington, DC 20001
USA

rod.schmitke@international.gc.ca

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