



**Joint Framework for Measuring C2 Effectiveness**  
**23-26 January 2012**  
**The Johns Hopkins University Applied Physics Lab, Laurel, MD**

# Terms of Reference

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<b>Table of Contents</b>	<b>Click to go to</b>
<b>Section #</b>	<b>Page</b>
Background and Workshop Vision .....	2
Objectives .....	2
Workshop Organization.....	3
Workshop Operations .....	3
Agenda.....	4
Working Groups (WGs).....	5
Security Procedures.....	6
Facilities .....	6

## Background and Workshop Vision

“How much is a pound of C2 worth? How much should it cost?”

Evaluating the effectiveness of command and control systems has been a perennial challenge to C2 systems procurement officials, operators, and analysts. What are the analytic processes, tools, skill sets, and techniques needed to evaluate C2 systems before and during procurement and then during operations? How are these analytics processes, tools, skill sets, and techniques similar and how are they different?

With the migration of command and control C2 systems to a networked architecture, it has become increasingly apparent that there is no common framework to measure and evaluate the effectiveness of networked C2 systems throughout the acquisition process and into operational use. In an effort to focus on this issue the Military Operations Research Society (MORS) will host a workshop to explore the analytic issues associated with evaluating C2 effectiveness, 24-27 January 2012 at the Kossiakoff Center, The Johns Hopkins University Applied Physics Laboratory in Laurel, Maryland.

Initially proposed by the Army's Training and Doctrine Command (TRADOC) Analysis Center (TRAC), this special meeting will look at the analytic issues associated with evaluating the effectiveness of networked C2 systems across all levels of the chain of command – strategic theater to tactical – and across the joint Range of Military Operations (ROMO) contemporary military forces are required to perform. Because these operations are invariably carried out in a coalition as well as joint operating environment, this workshop will encourage participation by representatives of non-US military forces.

## Objectives

During the workshop, participants involved in the application of analytic techniques in the development, procurement, test and evaluation, integration, certification and operation of networked C2 systems will be asked to present respective analytic techniques and their application in the respective elements in this range. Workshop attendees will discuss measurement links, commonalities, and disparities among these analytic techniques and develop a framework supporting the integration these techniques across the range of activities indicated above.

## Workshop Organization

Workshop Co-Chairs	Terry McKearney, The Ranger Group Dr. Lee Lehmkuhl, The MITRE Corporation
Tutorials Chair	Steve Topper, Johns Hopkins Applied Physics Laboratory (JHU/APL)
Integration and Synthesis Group Chair	Michael Pafford, JHU/APL
Bulldog	Sheilah Simberg, US Army Material Systems Analysis Activity
Working Group 1 Chair	LTC Gerry Benard, USA, TRAC Fort Leavenworth
Working Group 2 Chair	Dr. Suzanne Beers, The MITRE Corporation
Working Group 3 Chair	Clyde Smithson, JHU/APL
Working Group 4 Chair	Dr. Jennifer Ockerman, JHU/APL

## Workshop Operations

This workshop will employ the MORS traditional model of multiple working groups focused on complementary aspects of networked C2 and the analytic techniques needed to evaluate the use of networked systems in C2. Each working group will be co-chaired by senior participants with backgrounds in operations research, system analysis and network technology. Each working group chair will develop an abstract, agenda, and expected outcomes to shape the activities of the WG, and maintain a balance between presentations and deliberations. These will be consolidated into an abbreviated Terms of Reference (TOR) for each working group. These working group TORs are living planning documents to allow the working groups chair and co-chairs to shape their group in response to participant input. Since the workshop deliverable is a product addressing the above questions, deliberation and out-brief writing will require full participation from all workshop participants.

The Integration and Synthesis Working Group will look for common themes, and recommend real-time modification and refinements to the workshop. Additionally, this group will take the deliberations of each of the working groups and identify common analytic themes and practices that support the range of applications cited above and weave this into a framework that maps analytic techniques to their use in this range.

The workshop will be preceded by a set of tutorials on the various technical aspects of analysis as it applies to C2 and on the basics of network development relative to C2. The actual workshop will begin with a keynote speaker who will provide expert insight into the issues of using analytic tools in the assessment of C2 in a networked environment.

The workshop will be centered on the deliberations of the working groups. Attendees will

indicate their preference for working group participation upon registration and will be asked to participate fully in the deliberations of their working group. As in all MORS workshops, the working groups are an intellectually challenging and open exchange of information. Working group chairs will record the deliberations of their working groups and be prepared to brief these to the assembled participants in the workshop on the final day of the workshop.

Socializing and the free exchange of ideas are encouraged among workshop attendees. A social event will be held Tuesday night at the Kossiakoff center with complimentary hors d'oeuvres and a cash bar. Breakfast and snacks will be provided during the meeting. Lunch is an additional cost available for purchase at both online and on-site registration.

## Agenda

<b>Monday, 23 January 2012</b>	
1200-1600	Early Registration
1300-1600	Tutorials
	Mission Command and Mission Command Systems Measurements
	Workshop Integration and Synthesis Process
<b>Tuesday, 24 January 2012</b>	
0715-0800	Continental Breakfast and Registration
0800-0810	Plenary Session Kickoff and Welcome
0810-0815	Proponent's Welcome
0815-0855	Keynote Address
0855-0910	Charter to Working Groups
0915-1130	Working Group Session 1
1130-1300	Lunch with speaker – Lt. Gen. Walter E. Buchanan III, followed by Dr. Richard Hayes, of the DoD's Command and Control Research Program
1300-1700	Working Group Session 2
1730-1900	Mixer at the Kossiakoff Center
<b>Wednesday, 25 January 2012</b>	
0715-0800	Continental Breakfast and Registration
0800-1130	Working Group Session 3
1130-1300	Lunch
1300-1630	Working Group Session 4
<b>Thursday, 26 January 2012</b>	
0730-0800	Continental Breakfast and Registration
0800-1200	Working Group Session 5
1200-1300	Working lunch in Working Group sessions
1300-1300	Working Group 1 Outbrief
1330-1400	Working Group 2 Outbrief
1400-1420	Break
1420-1450	Working Group 3 Outbrief
1450-1520	Working Group 4 Outbrief
1520-1550	Integration & Synthesis Group Outbrief
1550-1630	Wrap up and Conclusion.
<b>Friday, 27 January 2012</b>	
0800-1200	Working Group and Integration & Synthesis Chairs gather to prepare final

## Working Groups (WGs)

<b>Working Group 1</b>	Deriving Operational Metrics for Networked C2	Chair	LTC Gerry Benard, USA, TRAC Fort Leavenworth
		Co-Chair	Bruce Gorski, The MITRE Corporation
		Advisor	Don Kroening, Booz Allen Hamilton

This working group will focus on the development of operational metrics that reflect the nature of C2 in a networked environment and the value of current C2 systems and those under development from the commander's perspective. Deliberations will include how these metrics will relate to sound decision making, the ultimate goal of C2.

<b>Working Group 2</b>	Analytic Support to C2 Acquisition	Chair	Dr. Suzanne Beers, The MITRE Corporation
		Co-Chair	Tylar Temple, AMSAA
		Co-Chair	Christina Shapiro, AMSAA

This working group will explore the optimal use of operations analysis in the acquisition process of networked systems. It will focus on the application of analytic tools and methods to quantify the value that the C2 system brings to the warfighter. Specifically, it will look across various examples of C2 system evaluation to determine recommended measures (e.g., how to quantify the value of information, how to translate data rates and volumes to information measures, etc.) and methodologies.

<b>Working Group 3</b>	Operations Analysis for Systems of System within a Networked C2 Context	Chair	Clyde Smithson, JHU/APL
		Co-Chair	Marjorie Greene, Center for Naval Analyses

Because networked C2 systems are actually "systems of systems" this working group will examine the difficulties of applying operations research techniques to them in this context. Networked systems exhibit behavior that is complex and defies the usual techniques of measuring effectiveness at discrete points. This working group will explore the correct approach for measuring and assessing network behaviors and the effectiveness of the network.

<b>Working Group 4</b>	Analysis of Human Decision Making in a	Chair	Jennifer Ockerman, JHU/APL
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## Networked Environment

Co-Chair      Sylvia Acchione-  
Noel  
TRAC-WSMR

This working group will focus on the analyst techniques needed to understand the dynamics of human decision making in a networked environment. While it is generally accepted that networks applied to C2 result in improved decision making for the commander, objectively measuring this improvement remains elusive. This working group will look at the challenge associated with the defining and measuring of “better” decision making.

### **Integration and Synthesis Group**

Chair      Michael Pafford,  
JHU/APL

Synthesis  
Chair      Greg Keethler

This group will review the deliberations of each working group, capturing the

- Tasks,
- Measures, and
- Analytic approaches discussed in each and
- Developing a consolidated mapping that links the four major areas of concern from the individual working groups.

This linkage will provide a framework of key C2 analytic methodologies for different levels of the chain of command and in different operational situations. The goal of this framework will be to inform the acquisition process by providing operationally oriented performance metrics for C2 systems.

The Synthesis subset of this group will collect the common themes uncovered during the working group deliberations and develop a summary report out on these issues along with an overall summary of the workshop's progress.

## **Security Procedures**

This workshop will be conducted at the UNCLASSIFIED level. Participation from non-U.S. experts involved in the issues of networked command and control is invited.

## **Facilities**

This workshop will be conducted at the Kossiakoff Center, The Johns Hopkins University Applied Physics Laboratory, 11100 Johns Hopkins Road, Laurel, MD 20723.

The conference hotel for the workshop will be the Columbia Sheraton, 10207 Wincopin Circle, Columbia, MD, (877) 207-9358. The MORS room block at per diem rate will be available until 9 January, 2012.