

Case Study of a Prototype Set of Behaviorally Anchored Rating Scales for C2 Assessment

Jim Murphy
*Dynamics
Research
Corporation*

Jock O. Grynoviki, PhD
*U.S. Army
Research
Laboratory*

Kragg P. Kysor
*U.S. Army
Research
Laboratory*

8th International
Command & Control Research & Technology Symposium
17-19 June 2001
National Defense University, Washington, DC

Outline

- 1 Background – Behaviorally Anchored Rating Scales (BARS) in Brief
- 2 Developing BARS to Describe “Battle Command Proficiencies
- 3 “Proof of Principle” during a Unit of Action Battle Command Experiment

Rating Scales

Numerical

1 2 3 4 5 6 7

Traits; e.g., “Quality of Work”

Hopeless Below Average Above Average Outstanding
Unsatisfactory Average Excellent

Behavioral

- 1 – The total “Job” is decomposed into major functions.
- 2 – Each function is described in terms of the range of observable behaviors that might be observed when an individual or team performs the function.
- 3 – The behaviors are evaluated from most effective in accomplishing the function, to least effective.

Rating Scales

Numerical

1 2 3 4 5 6 7

Traits; e.g., “Quality of Work”

Hopeless Below Average Above Average Outstanding
Unsatisfactory Average Excellent

Behavioral

Ineffective, Detracting

Basically Effective

Highly Effective Results

The battle staff invariably overruns the allocated time, taking up to 1/2 the time available. The staff simply has difficulty completing all the steps within the time intervals they initially determined. The unit tends to wait for the higher headquarters to announce the briefing and rehearsal schedule, and as a result, frequently does not begin to coordinate this schedule until they have completed their operations order. This causes other units to have to delay or reschedule

The commander and staff normally executes their planning requirements within the 1/3 – 2/3’s allocation of time. The staff first determines the amount of time in the 1/3 allocation, and further allocates it to the planning tasks. The staff tends to wait for the higher headquarters to announce its briefing and rehearsal schedule. The S3, with the CO’s approval, issues the unit’s own briefing and rehearsal times to the subordinate units.

The commander and staff are well-disciplined to execute their planning requirements within the 1/3 – 2/3’s allocation of time. The staff first determines the amount of time in the 1/3 allocation, then determines 1/4 of the time, and allocates the 1/4 to the MDMP planning tasks. Once planning is underway, the XO or S3 coordinates with HHQ to determine the times for the brief back to HHQ and the HHQ’s rehearsal. The S3, with the CO’s approval, issues the unit’s own briefing and rehearsal times to the subordinate units.

State of Michigan

Supervisor Competencies

Behaviorally Anchored Rating Scales

DECISION MAKING

Identifying and understanding issues, problems, and opportunities; comparing data from different sources to draw conclusions; using effective approaches for choosing a course of action or developing appropriate solutions; taking action that is consistent with available facts, constraints, and probable consequences.

Needs Improvement	Meets Expectations	High Performing
<ul style="list-style-type: none"> ■ Makes inappropriate or unauthorized decisions. Does not review appropriate information surrounding the decision making process, ignores the overall mission, and does not examine alternative solutions. ■ Does not see the big picture. ■ Seldom responds to problems, if at all; tends to avoid making decisions. Changes decisions frequently. ■ Dictates decisions while neglecting to provide rationale for the decisions. ■ Makes decisions based on inadequate information. Decisions are often not made in a timely manner. 	<ul style="list-style-type: none"> ■ Makes independent decisions when appropriate. Consults with others prior to making final decision when appropriate. ■ Demonstrates an understanding of the big picture and involves others in the decision making process to obtain buy-in before making decisions. ■ Makes decisions on a timely basis, commits to action, and follows up until decision is fully implemented. ■ Provides the appropriate amount of information when informing others of a decision. Clearly explains the rationale behind the decisions. ■ Analyzes problems, gathers applicable information and identifies issues relevant to problem areas before developing timely solutions. 	<ul style="list-style-type: none"> ■ Consistently generates alternative as well as creative solutions to solving problems. ■ Consistently incorporates elements of the big picture when making decisions to ensure effective participation by others. ■ Anticipates future problems and proactively responds. ■ Highly effective in providing rationale and explaining the decision making process. ■ Excels in organizing research surrounding a decision. Conducts or delegates appropriate investigative work before making decisions and responds in a timely manner.

Table 1.

Modified Smith & Kendall BARS Development Procedure ¹

Step	Participants	Activity
1	Group A	Incident Generation
2	Group A	Clustering & Scaling
3	Group B	Retranslation of Clustering & Scaling
4	Researchers	Reconciliation of Clusters, Rescaling
5	Researchers	Examination for Variance
6	Researchers	Final BARS

¹ Patricia Cain Smith and L.M. Kendell, "Retranslation of Expectations: An Approach to the Construction of Unambiguous Anchors for Rating Scales," Journal Applied Psychology, 47, No. 2 (1963), pp. 151-155.

Table 1.

Modified Smith & Kendall BARS Development Procedure ⁶

Step/ Participants	Activity
1 Group A	<p><u>Incident Generation</u></p> <p>Group A generates an exhaustive list of critical incidents and mid-range, average behaviors observed on the job. This should encompass all incidents from every facet of the job.</p>
2 Group A	<p><u>Clustering & Scaling</u></p> <p>First, Group A separates the incidents into clusters of related behaviors. The clusters, upon further refinement, emerge as job dimensions. Normally 8 to 12 job dimensions are identified. Second, the group scales the behaviors within each job dimension from “most effective” in terms of producing organizationally effective results to “least effective.”</p>
3 Group B	<p><u>Retranslation of Clustering & Scaling</u></p> <p>Group B is provided with the incident generated by Group A in Step 1. Group B then replicates the clustering and scaling tasks performed by Group A in Step 2. At this point the researcher has two sets of raw, unrefined BARS. This step is referred by Smith and Kendall as the retranslation step because it resembles the drill wherein a second student retranslates back into the original language a paragraph translated into English from a foreign language paper by a first student.</p>

- 4
Researcher Reconciliation of Clusters, Rescaling
The two groups' results are reconciled if necessary. Reconciliation will be necessitated by Group B identifying more, fewer, or significantly different job dimensions than Group A. Group A and B are asked to agree, if possible, on a set of job dimensions. To the extent agreement is reached, each group, separately, reassigns the incidents and behaviors effected by the reconciliation to the appropriate job dimension, and rescales those job dimensions in which changes have occurred. At this point the researcher carefully examines and compares the results. Those behaviors which were either not assigned to a job dimension or were assigned to different job dimensions by Group A and B are dropped
- 5
Researcher Examination for Variance
Each job dimension is examined in detail. The surviving behavioral incidents are examined for variance relative to the degree of agreement between Groups A and B where the specific behaviors should be located in the "most effective"—"least effective" behavior scale. This involves determining the mean scale rating for each retained incident, and its standard deviation as well.
- 6
Researcher Final BARS
Incidents whose degree of variance lie within pre-determined limits are retained; those which exceed the limits are dropped. The retained behaviors incidents residing with the job dimension agreed upon by Groups A and B constitute the resultant BARS. Normally the BARS will be comprised of 8 to 12 job dimensions and from 7 to 9 scaled behavioral incidents within each job dimension.

Advantages & Disadvantages of BARS

Advantages of Using BARS

- Identification of major job components
- Language of BARS is clear & unambiguous
- Pin-Point employee behavior
- Reduction of rater-ratee disagreement
- Improvement of performance

Disadvantages and/or Shortcomings of BARS

- High cost in terms of supervisor participation
- Problems caused by discarding behavior descriptions
- Complexity of behavior
- Dislike of the format
- Necessity for training

Uses of BARS

Originally, performance appraisal for individuals

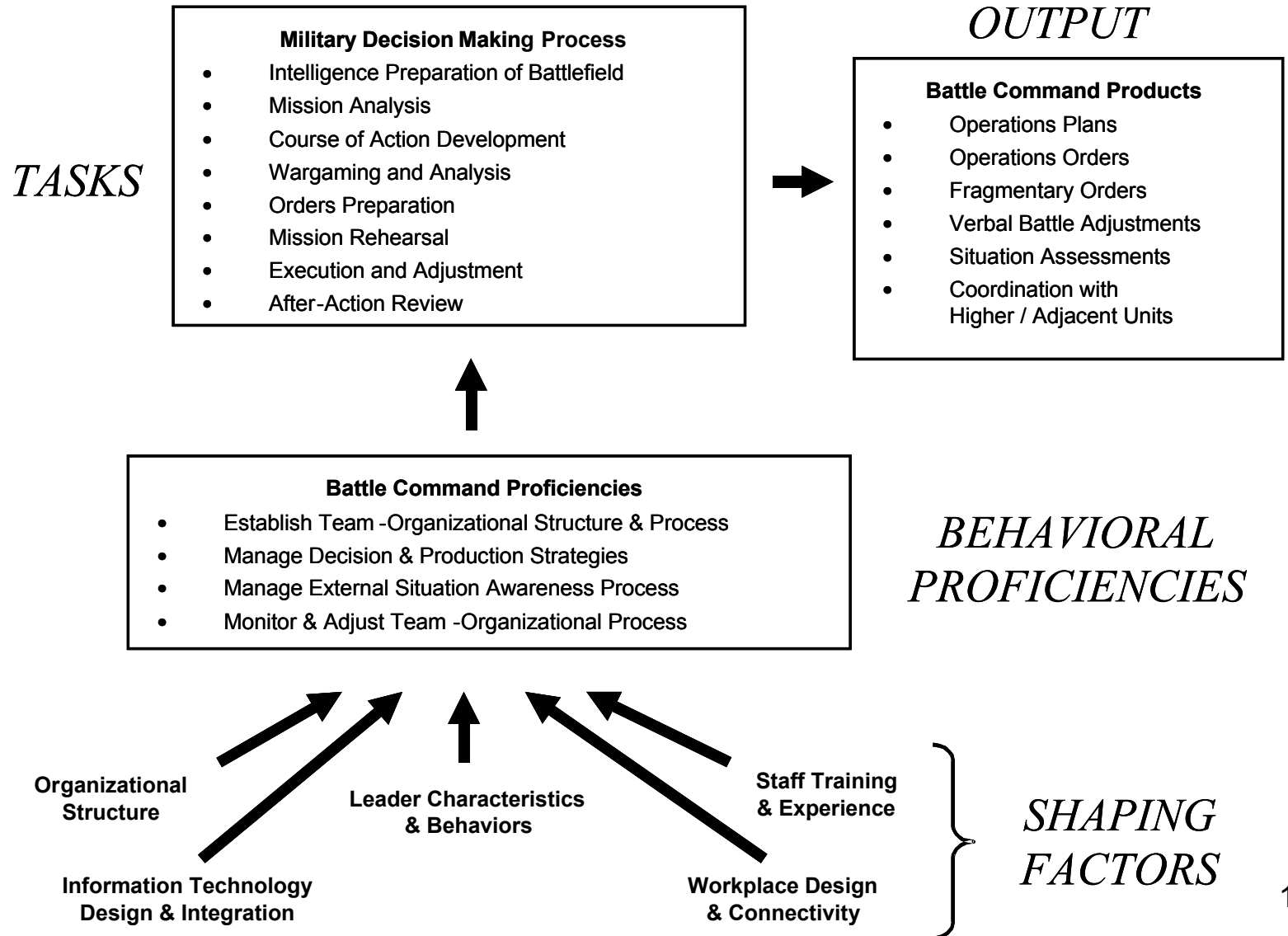
Team Self-improvement

Unit Training Assessment

Unit Readiness Evaluation

C2 Assessment for Experimentation & Materiel Development

Multi-Level Systems Model of Battle Command Performance



Commander-Battle Staff Team Proficiencies

Performance Objective		Behavioral Proficiency
Establish Team–Organizational Structure & Process	1	Clarify Expected Roles and Contributions of Individuals-Teams
	2	Establish Clear Strategy for Knowledge Management
	3	Establish Effective Information Exchange Practices
	4	Establish Supportive Behaviors and Error Monitoring
	5	Align Decision Authority With Decision-Making Capacity
Manage Decision And Production Strategies	6	Employ Proper Mix of Decision Strategies for Each Situation
	7	Effectively Manage the Collaborative Debate Process
	8	Sequence and Communicate Decisions and Assumptions
	9	Employ Proper Mix of Production Strategies for Each Situation
Manage External Situation Awareness Process	10	Balance Push-Pull of Information Flow to Decision-Makers
	11	Maintain Attentional Scanning Across Multiple Decision Threads
	12	Verify Key Information Inputs and Employ Proper Risk Management
	13	Manage Battlespace Images and Their Cognitive Shaping Influence
	14	Anticipate and Prepare for the Emergence of Complexity
Monitor & Adjust Team–Organizational Process	15	Manage Task Priority, Task Sequencing, and Information Cost
	16	Manage Process Error Associated With Staff Rotation and Handover
	17	Practice Continual Self-Critique and Organizational Learning

Manage Decision and Production Strategies

- 6 Employ Proper Mix of Decision Strategies for Each Situation
- 7 Effectively Manage the Collaborative Debate Process
- 8 Sequence and Communicate Decisions and Assumptions
- 9 Employ Proper Mix of Production Strategies for Each Situation

8 - Sequence and Communicate Decisions and Assumptions

A Proficiency & its Sub-proficiencies

One third, two-thirds rule and planning timelines

Timely warning orders and interim planning products

Use of Liaison Officers

8.1 One third, two-thirds rule and planning timelines

OBSERVATIONAL FOCUS Does the battle staff complete planning and issue the operations order within the one-third, two-thirds guideline? Does the battle staff develop an internal planning timeline very soon after receipt of mission and adhere to it? Does the battle staff subsequently coordinate timelines with its higher headquarters, and issue an expanded planning-briefing-rehearsal timeline to its subordinate units?

Below standards (Rating 1):

The battle staff invariably overruns the allocated time, taking up to 1/2 the time available.

The staff simply has difficulty completing all the steps within the time intervals they initially determined.

The unit tends to wait for the higher headquarters to announce the briefing and rehearsal schedule, and as a result, frequently does not begin to coordinate this schedule until they have completed their operations order.

This causes other units to have to reschedule certain activities.

The staff has difficulty with the _____ step in the MDMP

Meets standards (Rating 4):

The commander and staff normally execute their planning requirements within the 1/3 – 2/3's allocation of time.

The staff first determines the amount of time in the 1/3 allocation, and further allocates it to the planning tasks.

The staff tends to wait for the higher headquarters to announce its briefing and rehearsal schedule.

The S3, with the CO's approval, issues the unit's own briefing and rehearsal times to the subordinate units.

Exceeds standards (Rating 7):

The commander and staff are well-disciplined to execute their planning requirements within the 1/3 – 2/3's allocation of time.

The staff first determines the amount of time in the 1/3 allocation, then determines 1/4 of the time, and allocates the 1/4 to the MDMP planning tasks.

Once planning is underway, the XO or S3 coordinates with HHQ to determine the times for the brief back to HHQ and the HHQ's rehearsal.

The S3, with the CO's approval, issues the unit's own briefing and rehearsal times to the subordinate units.

Battle Command Proficiencies

4 Performance Goals

17 Proficiencies

62 Sub-proficiencies

One – Establish Team Organizational Structure & Processes

1. CLARIFY EXPECTED ROLES AND CONTRIBUTIONS OF INDIVIDUALS-TEAMS

- 1.1 Command Emphasis And Involvement
- 1.2 Individual Effort
- 1.3 Support to Decision-Making
- 1.4 Tacit Knowledge and “Know How”
- 1.5 Comportment, Common Sense, and Self-Confidence

2. ESTABLISH CLEAR STRATEGY FOR

- 2.1 Information Titling, Dating, Storage
- 2.2 Field Library
- 2.3 Manage Tacit Knowledge

3. ESTABLISH EFFECTIVE INFORMATION

- 3.1 Use Doctrinal Terms and Standards
- 3.2 Transfer Clear, Timely, and Complete
- 3.3 Verify Information Received
- 3.4 Acknowledge Receipt
- 3.5 Verify Acknowledgement

4. ESTABLISH SUPPORTIVE BEHAVIOR

- 4.1 Training to Anticipate Information
- 4.2 Anticipating Information Needs
- 4.3 Training to Monitor Decision-making
- 4.4 Monitoring Decision-making Effectiveness

5. ALIGN DECISION AUTHORITY WITH

- 5.1 Concept of Mission Command
- 5.2 Concept of Mission Command
- 5.3 Appropriate Authority Delegation

Two – Manage Decision & Production Strategies

6. EMPLOY PROPER MIX OF DECISION STRATEGIES FOR EACH SITUATION

- 6.1 Strategy Deliberately Selected
- 6.2 Strategy Justified by Situation and Conditions
- 6.3 Specified Team Member Involvement
- 6.4 Smooth Transition Among Strategies
- 6.5 Prescribed Roles in Analytical Process
- 6.6 Staff Input to Facilitate Recognition
- 6.7 Balanced Efforts When Managing

7. EFFECTIVELY MANAGE THE COLLECTIVE

- 7.1 Planning Decision Execution
- 7.2 Encouraging the Collaborative
- 7.3 Battle Drills

8. SEQUENCE AND COMMUNICATE INFORMATION

- 8.1 One Third, Two Thirds Rule
- 8.2 Timely Warning Orders and Instructions
- 8.3 Use of Liaison Officers.

9. EMPLOY PROPER MIX OF PRODUCTION

- 9.1 Know Advantages and Disadvantages
- 9.2 Choose Best Format for the Situation
- 9.3 Issue Timely Combat Orders

Three – Manage External Situational Understanding Process

10. BALANCE PUSH/PULL OF INFORMATION FLOW TO DECISION-MAKERS

- 10.1 Specified and Implied Information
- 10.2 Push / Pull Information
- 10.3 Use of Liaison Teams in the Push/Pull of Specified Information
- 10.4 Information Overload and Manual Tracking
- 10.5 Directed Telescopes

11. MAINTAIN ATTENTIONAL SCANNING

- 11.1 Responsibilities Assigned for Attentional Scanning
- 11.2 Attentional Scanning for Major Threats
- 11.3 Ensure Attentional Scanning is Effective
- 11.4 Prompt Action When Information is Detected

12. VERIFY KEY INFORMATION INPUT

- 12.1 Information Quality Control
- 12.2 Uncertainty and Risk Management

13. MANAGE BATTLESPACE IMAGES

- 13.1 Conceptual Skills
- 13.2 Graphics Technical Skills
- 13.3 Digital Skills
- 13.4 Current Operations Skills
- 13.5 Battle Management Skills

14. ANTICIPATE AND PREPARE FOR THE UNUSUAL

- 14.1 Alert to the Unusual
- 14.2 Rapid Reaction to the Unusual

Four – Monitor & Adjust Team-Organizational Process

15. MANAGE TASK PRIORITY, TASK SEQUENCING, AND INFORMATION COST

- 15.1 Internal Tasks and Sequencing
- 15.2 Information Costs
- 15.3 Tolerance for Information Uncertainty

16. MANAGE PROCESS ERROR ASSOCIATED WITH STAFF ROTATION AND HANDOVER

- 16.1 Review the Wargame and the Plan Synchronization
- 16.2 Battle Tracking Overlay
- 16.3 Rehearsal
- 16.4 Persons Attending Shift Change Briefings.
- 16.5 Content of Shift Change Briefings
- 16.6 Knowledge of Subordinate Unit Activity During Preceding Shift

17. PRACTICE CONTINUAL SELF-CRITIQUE AND ORGANIZATIONAL LEARNING

- 17.1 Battle Staff After-Action Reviews
- 17.2 Battle Command Proficiencies Included in AAR
- 17.3 Innovative Analysis Techniques to Improve Understanding of Performance

STEP	OBJECTIVE	APPROACH	
1 Theoretic Definition	Expand proficiency definitions into a detailed discussion of proficiency goals and pathways by which each shaping factor influences behaviors (construct validity)	In-depth review of existing research literature	
2 Behavioral Description	Identify and rank-order sets of behavioral markers that characterize unacceptable, minimally acceptable, and superior levels of proficiency along each dimension (face validity)	Critical incident analysis, based upon data available from previous AWE events, NTC/JRTC rotations, and CALL database	
3 Observer/Rater Facilitation	Develop observer/rater training materials that focus attention on key aspects of each proficiency and facilitate systematic assessment of battle command behaviors during an exercise (rating validity)	Lecture material, supplemented with case studies and sample observation exercises for developing inter-rater reliability	
4 Field Demonstration	Conduct actual applications of the C4ISR framework (and associated BOS/BARS scales) within on-going battle staff exercises and field experimentation: (1) organization of experimentation issues, (2) collection of performance observations, and (3) analysis of findings and insights	SMITH & KENDALL, 1963	
		Step/ Participants	Activity
5 Database Development	Develop a central repository for C4ISR combat development assessment, organized by battle command proficiencies cross-walked against both shaping factors and higher levels of C4ISR system performance (criterion validity)	1 Group A	Incident Generation
		2 Group A	Clustering & Scaling
		3 Group B	Retranslation of Clustering & Scaling
		4 Researcher	Reconciliation of Clusters, Rescaling
6 Product Handoff	Document battle command proficiency findings and insights in appropriate forms for handoff to training developers, materiel developers, and combat development centers	5 Researcher	Examination for Variance
		6 Researcher	Final BARS
		CECOM	

Figure 1. Research Steps for Developing a C4ISR Assessment Framework

Unit of Action Battle Command Experiment

*Battle Command Battle Lab – Leavenworth
Fort Leavenworth, KS
27 January - 7 February 2003*

Scope of the Experiment

- Focus on the new UA Brigade level staff structure.
- Conduct multiple operations using a new decision-making process (DMP)
- Use insights to help refine the core functions of Battle Command.
- Provide preliminary data on the UA structure and the new DMP.

Major Research Questions Focused on the Army's Objective Force

- 1 – Does the UA Brigade command and staff structure enable battle command?
- 2 – Does the Recognition Planning Model (RPM) support planning, execution and decision-making across the full spectrum of military operations?
- 3 – Is the UA Brigade Staff able to conduct distributed planning?
- 4 – How does Commander's Intent facilitate decentralized execution?
- 5 – What are sufficient characteristics of collaboration tools for the commander?

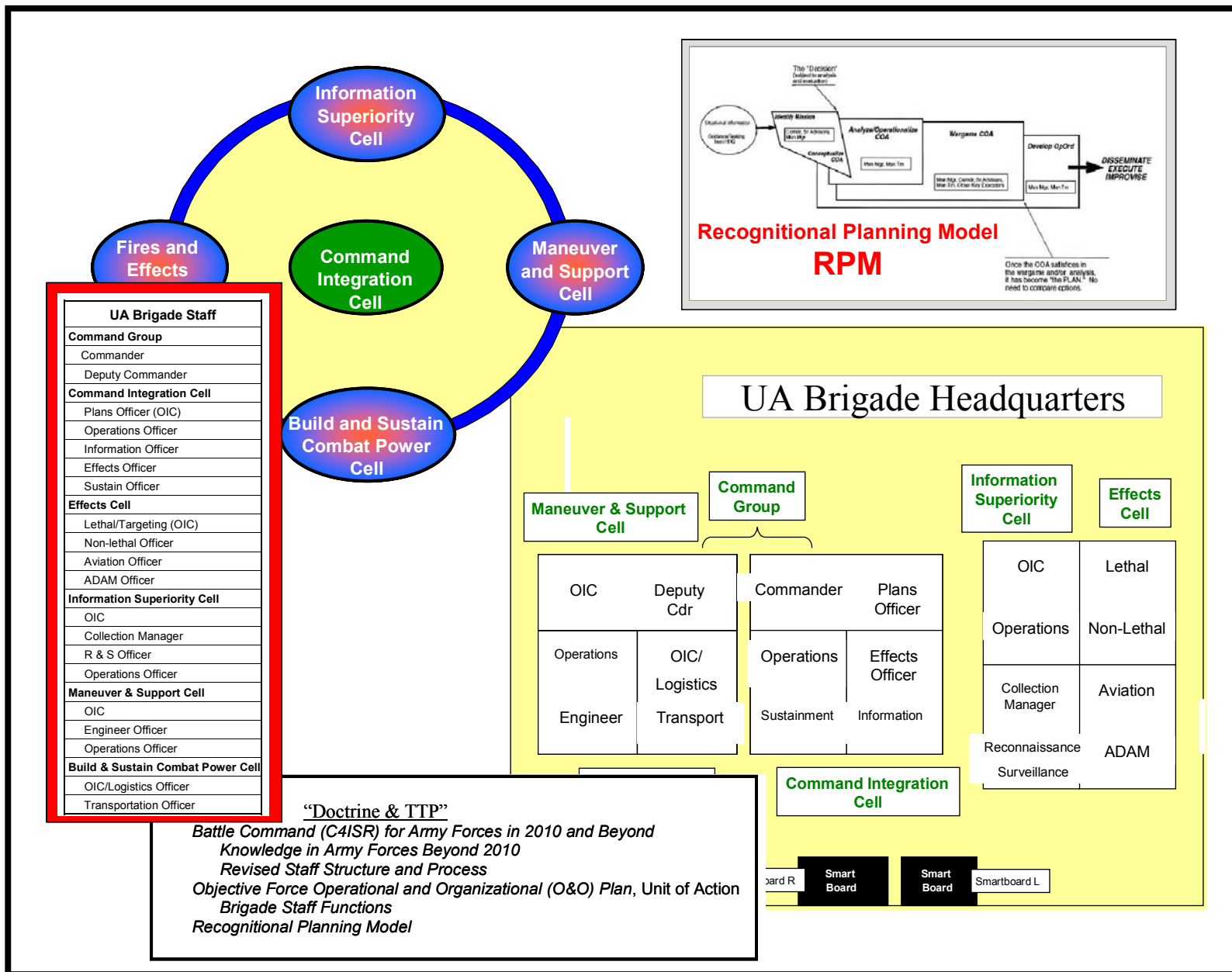
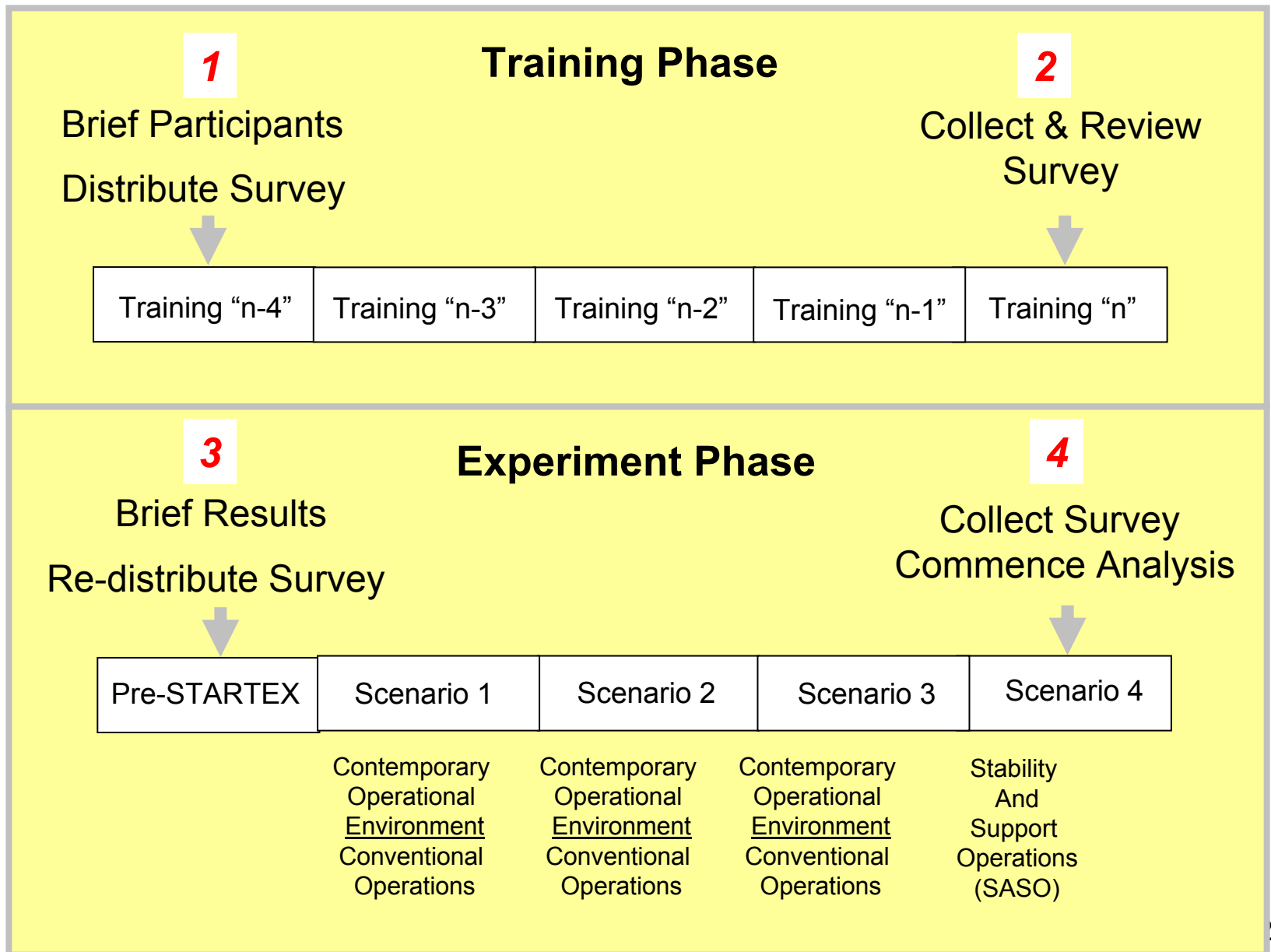


Figure 2. Future Staff, RPM Diagram, UA Staff Positions, and Doctrinal Framework

Preparation for & Use of the Survey



10. BALANCE PUSH/PULL OF INFORMATION TO DECISION-MAKERS

OBSERVATIONAL FOCUS The emphasis in this proficiency that the team has a clear mental picture of what information is relevant to HHQ and subordinate units in a given situation, and that it already has in place the reporting procedures for reporting to HHQ and for receiving reports from subordinate units. This should minimize the necessity to pull information from a subordinate unit, and similarly, the necessity to have to respond to pull requests from HHQ. The unit TACSOP should reflect an integrated approach to information flow. If the unit has not described its information TTP in writing, the observer should see persons taking the initiative to push appropriate information as it is received—such as SPOT reports of significant contact—or as it is scheduled to be sent, such as twice-daily operation summaries and intelligence summaries. The observer should see a minimum of information pull. When the

operational pace quickens, and the staff is being overloaded with information, the observer should expect the senior staff members to tighten the filters for the information they want their subordinates to pass to them for consideration.

Liaison teams should be fully aware of their information push and pull responsibilities. Normally, they will be focused on ensuring the battle staff is apprised of all relevant information bearing on their parent unit. If the commander chooses to use a “directed telescope,” the tasking should be treated as regular mission, and should be fully coordinated and synchronized. The following outlines specific proficiency elements to be observed:

10.1	<p>Relevant Information. Do the battle staff members understand what information is relevant in the present situation? Has the unit developed procedures to ensure the junior staff members pass only relevant information and other exceptional, time-critical information to the commander or designated senior staff members?</p>	7	6	5	4	3	2	1
	<p>The command's TACSOP lists the types of information that generally becomes relevant in a tactical situation, and the officers and NCOs on the staff have a clear understanding the types of information that are relevant in a given situation. The operators and NCOs in the staff sections are well-drilled in routing relevant and exceptional information to designated senior staff members, and other important but not immediately relevant information to other designated staff members.</p>				<p>Although the TACSOP does not provide a description of relevant information, the key staff members have a good idea what is relevant in a given situation. Operators and NCOs in the sections understand the concept of relevant information, but have not been given explicit guidance routing it within the staff.</p>			<p>Generally, none of the staff members are clear on what information is relevant in a given situation. Operators and NCOs in the sections tend to pass all information to the senior person in the section</p>
10.2	<p>Push / Pull Information. Does the staff understand what information should be pushed and to which individuals or commands and under what circumstances? Does the staff ensure that this information is pushed on a timely basis? Does the staff understand what information should be pulled and from which individuals or commands and under what circumstances? Is the staff proactive in pushing and pulling the information?</p>	7	6	5	4	3	2	1
	<p>The document also lists by title the reports that are to be pushed and pulled. Persons responsible for pushing and pulling also identified. All persons working in TAC have been trained in “information and reports management,” and are alert to the requirements in the TACSOP. During operations, the battle staff members are alert to ensuring their information is pushed as necessary. In order to confirm that the information being requested from subordinates is sufficiently necessary as to justify the effort and the distraction, staff officers discuss the request with counterparts to get a “peer check.”</p>				<p>The command's TACSOP lists by title the reports that are to be pushed and pulled, but persons responsible for pushing and pulling the reports are not identified. The XO and other senior battle staff members have oriented the staff to the reports and to their actual routing during operations. During operations, the staff is conscientious about sending push type information. Though careful not to request too much pull information, the staff has no peer check to act as a governor on excessive use this technique.</p>			<p>The command's TACSOP does not describe reporting in a manner that provides guidance on push and pull information. The XO and other senior battle staff members have oriented the staff to the reports and to their actual routing during operations. During operations, the staff is frequently forgetful and inattentive to timeliness for submission of required (push) reports to HHQ. The staff tends to ask for excessive amounts of pull information from subordinate units, and frequently asks for information during enemy contacts when the subordinate staff needs to be able to concentrate on the situation</p>
10.3	<p>Use of the Liaison Teams in the Push / Pull of Relevant Information. Does the command use the liaison teams located in its TOC to assist in the push / pull of relevant information? Has the command briefed its own liaison teams on their roll in expediting the pus / pull of relevant and exceptional information?</p>	7	6	5	4	3	2	1
	<p>The TACSOP lists the responsibilities of liaison teams assigned to the TOC. The TACSOP is highly specific in describing in the information the liaison teams are responsible for acquiring and for providing to their organizations. One of the senior members of the TOC staff is assignee to brief liaison officers on their responsibilities. A copy of the TACSOP is provided to the liaison teams.</p>				<p>The TACSOP lists the responsibilities of liaison teams assigned to the TOC. A copy of the TACSOP is provided to the liaison teams. No extra effort is made to ensure the liaison teams are well-oriented to their information role.</p>			<p>The unit TACSOP has no section addressing the reporting responsibilities of liaison teams. The liaison team is not oriented to its information responsibilities upon arrival at the command post.</p>

Cont'd

Figure 5. Example of a BCP BARS Assessment Instrument

Behavioral

Ineffective, Detracting

The battle staff invariably overruns the allocated time, taking up to 1/2 the time available. The staff simply has difficulty completing all the steps within the time intervals they initially determined. The unit tends to wait for the higher headquarters to announce the briefing and rehearsal schedule, and as a result, frequently does not begin to coordinate this schedule until they have completed their operations order. This causes other units to have to delay or reschedule

Basically Effective

The commander and staff normally executes their planning requirements within the 1/3 – 2/3’s allocation of time. The staff first determines the amount of time in the 1/3 allocation, and further allocates it to the planning tasks. The staff tends to wait for the higher headquarters to announce its briefing and rehearsal schedule. The S3, with the CO’s approval, issues the unit’s own briefing and rehearsal times to the subordinate units.

Highly Effective Results

The commander and staff are well-disciplined to execute their planning requirements within the 1/3 – 2/3’s allocation of time. The staff first determines the amount of time in the 1/3 allocation, then determines 1/4 of the time, and allocates the 1/4 to the MDMP planning tasks. Once planning is underway, the XO or S3 coordinates with HHQ to determine the times for the brief back to HHQ and the HHQ’s rehearsal. The S3, with the CO’s approval, issues the unit’s own briefing and rehearsal times to the subordinate units.

Item No.	Partic. No.	Response						
		7	6	5	4	3	2	1
1.1	1			●				
1.1	2			●				
1.1	3			●				
1.1	4			●				
1.1	5			●				
1.1	6			●				
1.1	7			●				
1.1	8			●				
1.1	9			●				
1.1	10			●				
1.1	11			●				
1.1	12			●				
1.1	13			●				
1.1	14			●				
1.1	15			●				
1.1	16			●				
1.1	17			●				
1.1	18			●				
1.1	19			●				
				19				

Figure 6. Ideal set of Responses from All Observers of a Single Sub-proficiency

Item No.	Partic. No.	Response						
		7	6	5	4	3	2	1
3.1	1	<input type="checkbox"/>						
3.1	2							
3.1	3					●		
3.1	4							
3.1								
3.1	8		●					
3.1	9					●		
3.1	10					●		
3.1	11							
3.1	12					●		
3.1	13					●		
3.1	14							●
3.1	15		●					
3.1	16			●				
3.1	17					●		
3.1	18							●
3.1	19				●			
Total			2	2	2	7	1	1

Item No.	Partic. No.	Response						
		7	6	5	4	3	2	1
3.3	1	<input type="checkbox"/>						
3.3	2			●				
3.3	3				●			
3.3	4				●			
3.3								
3.3	8		●					
3.3	9					●		
3.3	10					●		
3.3	11					●		
3.3	12				●			
3.3	13				●			
3.3	14			●				
3.3	15				●			
3.3	16				●			
3.3	17				●			
3.3	18				●			
3.3	19				●			
Total		1		4	11			

Item No.	Partic. No.	Response						
		7	6	5	4	3	2	1
5.1	1	<input type="checkbox"/>						
5.1	2			●				
5.1	3		●					
5.1	4		●					
5.1								
5.1	8		●					
5.1	9		●					
5.1	10				●			
5.1	11		●					
5.1	12	●						
5.1	13					●		
5.1	14			●				
5.1	15			●				
5.1	16		●					
5.1	17			●				
5.1	18		●					
5.1	19		●					
Total		1	9	6	1	1		

Item No.	Partic. No.	Response						
		7	6	5	4	3	2	1
11.1	1	<input type="checkbox"/>						
11.1	2							●
11.1	3				●			
11.1	4				●			
11.1								
11.1	8			●			●	
11.1	9						●	
11.1	10					●		
11.1	11		●					
11.1	12				●			
11.1	13				●			
11.1	14				●			
11.1	15			●				
11.1	16		●					
11.1	17			●				
11.1	18			●				●
11.1	19			●				
Total		1	4	8	2	2	1	

Figure 8. Group Variability Within a Single Sub-proficiency

Participant	Proficiency Scale							Variability (# of cells)	Total Responses	Median
	7	6	5	4	3	2	1			
1	26			1				1+	27	7
2	4	2	6	8	3	1	4	7	28	4
3	2	5	11	7	5			5	30	5
4	6	11	5	2	1			5	25	6
5	1	4	12	5	1			5	23	5
6		6	7	16	3	2	1	6	35	4
7		5	14	7	7			4	33	5
8	1	14	9	4	2	2		6	32	5
9	2	5	1	11	10	2	4	7	35	4
10		1	6	20	7	1		5	35	4
11		8	4	11		1		4	24	4.5
12	2	6	5	12	1	2		6	28	4
13			4	20	4			3	28	4
14			7	5	12	11		4	35	3
15		5	18	12				3	35	5
16		9	13	13				3	35	5
17		3	18	9	5			4	35	5
18		1	2	9	3	6	4	6	25	3.5
19		2	9	22	1			4	34	4




	Participant's most frequently reported proficiency scale
	Participant's second most frequently reported proficiency scale
	Participant's third most frequently reported proficiency scale

Figure 7. Individual Variability in Sub-proficiency Responses for All Participants

Row	Prof. No.	Responses ~ All Participants						Variability (# of cells)	Total Responses	Median	At least 2/3's Responses fell within 1, 2, or 3 adjacent cells			Note
		7	6	5	4	3	2				1	1	2	
1	1.1	2	5	8	3		1	5	19	5		●		
2	1.2		1	6	7	2	2	5	18	4		●		
3	1.3			4	8	4	1	4	17	4		●		
4	1.4		1	6	7	2		4	16	4		●		
5	1.5	1	3	5	5	1	1	6	16	4			●	
6	3.1		2	2	7	1	1	6	15	3			●	
7	3.2		1	3	8	1	2	5	15	4		●		
8	3.3		1	4	11			3	16	4	●			
9	3.4			1	7	4	1	4	13	4		●		
10	3.5			3	6	3	1	4	13	4		●		
11	4.1			1	6	2	2	4	11	4		●		
12	4.2		3	5	5	2		4	15	5		●		
13	4.3			5	5		1	4	13	4		●		1
14	4.4		1	3	4	3	2	5	13	4		●		
15	5.1	1	9	6	1	1		5	18	6		●		
16	5.2		6	3	6	2	1	5	18	4.5		●		2
17	5.3	3	6	5	2	1		5	17	6			●	
18	6.1	1	2	7	5	3		5	18	5		●		
19	6.2	2	5	6	5			4	18	5			●	
20	6.3	3	7	5	2	2		5	19	6			●	
21	6.4	2	1	8	4	2		5	17	5		●		
22	6.5		4	2	6	2	1	5	15	4			●	
23	6.6	2	7	5	3			4	17	6		●		
24	6.7		3	3	8	2	1	5	17	4		●		
25	10.1		2	6	7	1		4	16	4.5		●		
26	10.2		1	5	6	3	1	5	16	4		●		
27	10.3		1	1	4	1	1	6	11	4				2
28	10.4			2	8	4	1	5	16	4		●		
29	10.5		1	2	6	2	2	5	13	4			●	
30	11.1		1	4	8	2	2	6	18	4		●		
31	11.2		2	8	5	3		4	18	5		●		
32	11.3			3	8	2	2	5	17	4			●	
33	11.4	1	3	5	7		1	5	17	5		●		
34	14.1	1	4	5	5		1	6	17	5			●	1
35	14.2	1	4	5	5	1	1	6	17	5			●	
Note:	1	Responses in two separated clusters									1	23	10	
	2	Responses continuous but in two lobes												




	No. of responses = or > 50% (1/2)
	No. of responses = or > 50% (3/8)
	No. of responses = or > 50% (1/4)

Figure 9. Group Variability Across the Set of Sub-Proficiencies

Surrogate for “Agreement”

2/3's of the evaluations
fall within two adjacent
cells

“Agreement”	24
<u>No “agreement”</u>	<u>11</u>
Total	35

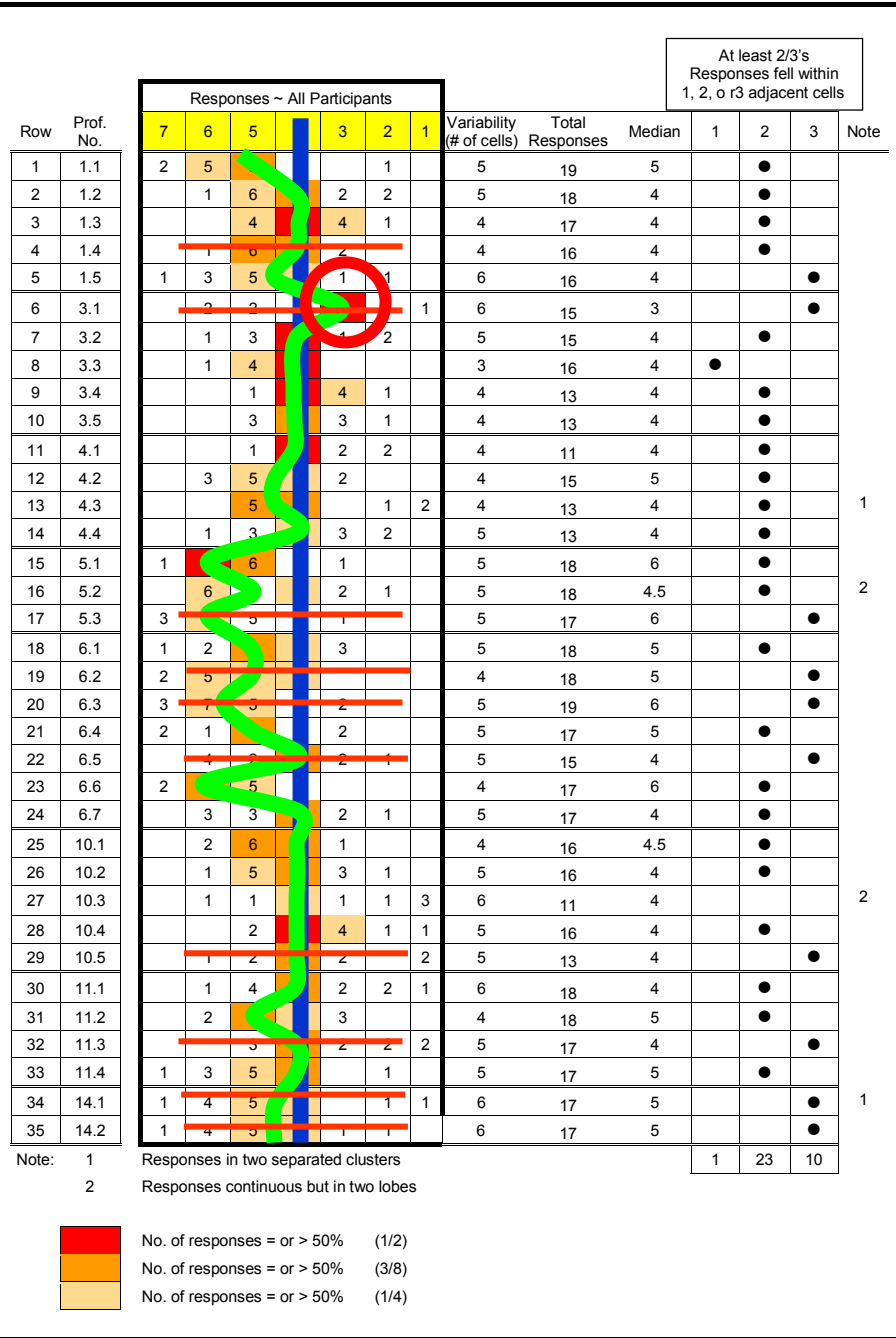


Figure 9. Group Variability Across the Set of Sub-Proficiencies

Perspectives on the Unit of Action Battle Command Experiment

- C2 BARS have potential as a C2 Assessment method
- The current anchors demonstrate the range of critical incidents that could be generated by a team of active duty SMEs
- The BARS development process is relatively simple and straightforward
- Continued study of the issue has identified refinements to the C2 BARS development process
- The short term cost to develop the Battle Command Proficiencies BARS is small compared to the benefits suggested by this “Proof of Principal” effort.

Determine Optimum Incident Generation Technique

SMITH & KENDALL, 1963	
Step/ Participants	Activity
1 Group A	Incident Generation
2 Group A	Clustering & Scaling
3 Group B	Retranslation of Clustering & Scaling
4 Researcher	Reconciliation of Clusters, Rescaling
5 Researcher	Examination for Variance
6 Researcher	Final BARS

LEEDOM, 2000	
Step	Objective
1 Theoretic Definition	Expand proficiency definitions into a detailed discussion of proficiency.
2 Behavioral Description	Identify and rank-order sets of behavioral.
3 Observer/Rater Facilitation	Develop observer/rater training materials.
4 Field Demonstration	Conduct actual applications of the C4ISR framework (with BOS/BARS scales) within on-going battle staff exercises and field experimentation.
5 Database Development	Develop a central repository for C4ISR combat development assessment.
6 Product Handoff	Document battle command proficiency findings and insights.

Thoughts for the Next Phase of the Project

- MUST have SMEs to generate observed and projected behaviors
- Need at two groups of at least 8 each for at least three weeks
- Need to produce valid reliable mid range behaviors
- Must be expressed in plain, military language
- Design of the training materials and BARS formats is important
- Finding “digitally proficient” SMEs may be a challenge