

Using the Command and Control Framework to Analyse Command Challenges

Carol McCann

Ross Pigeau

Defence R&D Canada - Toronto
1133 Sheppard Ave W.
Toronto, ON M3M 3B9
416 635-2190
carol.mccann@drdc-rddc.gc.ca
ross.pigeau@drdc-rddc.gc.ca

Allan English

KMG Associates
83 Gore St.
Kingston, ON K7L 2L4
613 544-5294
kmg1@sympatico.ca

Abstract

This paper describes a study addressing the validation of the Pigeau-McCann framework for command and control. The framework is a re-conceptualization of command, control and C^2 that is intended to provide a comprehensive and consistent base both for the scientific investigation of C^2 and for the development of military C^2 policy and doctrine. The validation approach involved the assessment of the explanatory power of the framework in the context of actual situations in which military personnel confronted operational challenges. The results endorse the value of the framework as a tool for categorizing and quantifying aspects of command, of control and of C^2 . Furthermore, with refinement, the tool could also be used by the military to analyse and understand challenging C^2 situations.

1. Introduction

Over the last 5 years, Pigeau and McCann have been developing a re-conceptualization of command, control and C^2 that is intended to provide a comprehensive and consistent framework both for the scientific investigation of C^2 and for the development of military C^2 policy and doctrine. The intention of this new framework is to provide a unifying construct for discussing, exploring and explaining the multi-faceted nature of command and control.

In the past, C^2 had been defined in a seemingly *ad hoc* fashion, reflecting either particular support technologies (e.g., $C^3 = C^2 + \text{computers}$, $C^4 = C^3 + \text{communications}$) or particular problem domains for which technological solutions were being developed (e.g., $C^4I = C^4 + \text{information}$, $C^4IS = C^4I + \text{surveillance}$, $C^4ISR = C^4IS + \text{reconnaissance}$, etc). What was missing was a central construct that stated, explicitly, the *purpose* for which these support technologies were being developed. What was lacking was a perspective that allowed command and control to be treated consistently from a single theoretical position.

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The core axiom that *only humans command* provides the necessary unifying construct, the construct on which the Pigeau-McCann framework bases its new definitions of command and of control. In addition, the framework hypothesizes a set of capabilities that are necessary and sufficient for effective command, it establishes the proper relationship between command and control and it re-defines the concept of C^2 in terms of common intent. Portions of the framework have been reported at previous CCRTS Symposia [McCann and Pigeau, 1996], [McCann and Pigeau, 1999] at both Human in Command symposia [Pigeau and McCann, 2000a], [Pigeau and McCann, 2001] and in military publications e.g., [Pigeau and McCann, 2002].

This study describes the analysis of a collection of command challenges (CCs) from the perspective of the framework, where the aim was to identify consistent command themes arising from these challenges. The study also assessed the general validity of the framework for its applicability to real world military situations.

We begin by briefly describing the framework. This is followed by an outline of the approach taken for the analysis and a discussion of the results.

2. Framework for Command and Control

The Pigeau-McCann framework for command and control clearly separates the concepts of command, control and C^2 . The concept of *command*, the centerpiece of the framework, is defined as “the creative expression of human will necessary to accomplish the mission” [Pigeau and McCann, 2002]. This places command (and by extension, C^2) squarely in the domain of the human, asserting that human qualities like judgement, motivation, and courage are essential for effective command. The framework, however, does not limit command only to commanders (see [Pigeau and McCann, 2000b] for a discussion of the distinction), but instead argues that, in principle, any human can command. It further hypothesizes that the degree of *command capability* embodied by a military person is a function of that person’s competency, authority and responsibility.

These three dimensions of command capability can be further subdivided as follows:

Competency

- Physical competency - the ability for sustained and skilled performance of tasks requiring physical effort and involving the senses and the body (e.g., the ability to see and hear well, endurance).
- Intellectual competency - the ability for skilled performance of mental or intellectual tasks such as reasoning, problem solving, creativity, decision making, visualizing, planning, judgment and ability to learn.
- Emotional competency - the ability to handle and cope with situations that are personally stressful or that are stressful for others.
- Interpersonal competency - the ability to interact socially with other individuals including the ability to speak and write well, to show concern for others, to be perceptive in social situations.

Authority

- Legal authority - the degree of formal power given to an individual by the military organization, specifically, the power over resources and personnel.
- Personal authority - the degree of informal power given to an individual by others, including subordinates, peers and superiors, earned, for example, through reputation, integrity, experience, strength of character and personal example.

Responsibility

- Extrinsic responsibility - the willingness of an individual to be held accountable for his or her actions to another person or to an organization.
- Intrinsic responsibility - the degree of personal commitment (moral or otherwise) that an individual feels towards another individual, towards an organization, or towards the mission.

It is proposed that the ideal levels of competency, authority and responsibility held by military members will increase with rank and experience. Furthermore, the competency, authority and responsibility of any individual must be in balance for effective command – that is, the degree of an individual’s competency must be commensurate with the degree of authority, and that authority, in turn, must be commensurate with the person’s responsibility. Crucially important is the balance across the authority-responsibility dimensions. If a member holds high authority without a commensurate degree of responsibility, which the framework terms “dangerous command”, there is potential for mis-use of that authority. Conversely, when responsibility exceeds authority – that is, a military member feels more accountable or more committed than the level of authority given or earned – this can lead to “ineffectual command”. Both of these imbalances must be avoided, as, indeed, must any imbalance between these dimensions and that of competency. The framework introduces the idea of the *Balanced Command Envelope (BCE)* to refer to that desirable portion of the command capability space where the three dimensions are balanced, and where it is desirable that all military members lie. The command capabilities and the implications of an imbalance in the command dimensions are discussed in more detail in [McCann and Pigeau, 1999] and in [Pigeau and McCann, 2000b].

The second important concept within the framework is that of *control*. The framework defines the concept of control as “those structures and processes devised by command to enable it and to manage risk” [Pigeau and McCann, 2002]. Control’s sole purpose is to support command by allowing it to take action in the operational context. In essence, control consists of the set of tools that have been developed and implemented by humans to help them command efficiently, and especially, to help them handle operational uncertainty. Control structure and process is instantiated in a variety of mechanisms, including doctrinal guidelines, rules of engagement, organizational structure, software technologies and equipment. The relationship between command and control and the notion of control as a support for command is explored in [McCann and Pigeau, 1999].

The concept of *command and control* (C^2) is the third principle concept that is addressed by the framework and it is defined as “the establishment of common intent to achieve coordinated action”. The core idea in this definition is that of common – i.e., shared – intent. According to the framework, there are two parts to intent. The first is *explicit intent*, the part of intent that is made publicly available through orders, briefings, questions and discussions.

But since it is impossible to be completely explicit about every aspect of an operation, the interpretation of explicit intent is supported by a vast network of *implicit intent*. Implicit intent derives from personal expectations, military training, tradition and ethos and from deep cultural values. The framework proposes that all members of a military organization must share intent at both the explicit and implicit level for C² to be successful. The concept of common intent as a basis for C² and the mechanisms by which intent is shared are addressed in [Pigeau and McCann, 2000a].

These principle concepts of the Pigeau-McCann framework, namely, the concepts of explicit and implicit intent, the command capabilities, control support for command and the balanced command envelope were assessed in the validation study, using the approach described in the next section.

3. Method

The assessment involved first, the collection of actual military situations where a person was placed in a challenging command situation; and then, the analysis of these challenges by a panel of experts using an assessment tool derived from the framework. This section describes the procedure for collecting the command challenges (CCs), the membership of the assessment panel, the assessment tool, and the procedure used for making assessments.

3.1 Description of Command Challenges

Fifty written descriptions of situations in which members of the army had been faced with challenging command situations were submitted by an independent group of researchers and serving members. Almost all these challenges occurred within the last 10 years. Thirty-two of these were submitted by researchers (most of whom held post-graduate degrees in history, war studies or the behavioural sciences) and were derived from publicly-available documentary sources such as official DND documents, books and articles. The remaining 18 were submitted by 11 serving members based on their personal experience¹. The descriptions were typically 2-4 pages in length and included title, geographic location and date, background to the situation, a description of the challenge, a comment on the command issues raised by the challenge, and the bibliographic source(s) of the material used in the submission. The challenges varied widely in geographic location (e.g., Kosovo, Croatia, Haiti, Cyprus, Canada), encompassing the diverse settings of Canadian army operations in the last decade. Contributors were given a considerable degree of latitude in the content of the challenges and thus the set reflected a broad range of issues, among them, training and operational preparedness, use of rules of engagement, illegal conduct, treatment of refugees, harassment, ethics, discipline, and creative problem solving.

3.2 Assessment Panel

A panel of five members, four with extensive military service and one civilian, was formed to undertake the detailed assessment of the command challenges. The military members each

¹ Serving members were instructed to avoid mentioning any characteristics that would identify individuals in the command situation, including specific dates and locations. The identity of individuals in the researchers' accounts were on the public record.

had between 27 and 36 years of experience in the Canadian Forces, two of them in the army and the other two in the navy and air force. One member had experience both as a non-commissioned member and in the reserve. All but one had graduate-level academic training in the area of history, war studies, or psychology. Together, the panel members provided a considerable breadth of military and academic experience.

3.3 Assessment Tool

The assessment tool consisted of a set of questions that were intended to explore the adequacy of the framework in accounting for the command challenges.

Part A of the tool addressed the eight hypothesized capabilities of command (e.g., physical competency, personal authority, intrinsic responsibility, etc.). The panel members were asked to judge whether the particular capability was an issue in the CC, and if so to select, from a list provided, the primary and support factor(s) involved. Primary factors referred to particular aspects of the capability associated with the person in the command situation. For example, primary factors under interpersonal competency included the ability to use language (e.g., articulateness, interpretation), opportunity for interaction with others (e.g., number, visibility, availability), and social maturity (e.g., empathy, sensitivity to the wider situation, tolerance). Support factors referred to the control structures and processes that were expected to support the command capability. Again, in the case of interpersonal competency, these included communication methods (e.g., radios, computer, in-person), organizational policies (e.g., on talking to the media, on visiting troops), and training (e.g., in public speaking, writing, media awareness).

Part B of the assessment tool addressed the concept of the Balanced Command Envelope (BCE), asking the respondents to judge, on a 5 point Likert scale, whether the individual involved in the particular command challenge was on the BCE. Then the panel members were asked to categorize the adequacy of that individual's command capability in each of the three principle dimensions (i.e., competency, authority and responsibility) in terms of "less than adequate", "adequate" or "more than adequate".

In part C, the panel members judged whether common intent was an issue in the CC. Panel members were also queried concerning relevant aspects of explicit intent in the CC such as aim or purpose, the language, the means of communication, and the time available for transmitting explicit intent as well as relevant aspects of implicit intent (e.g., person, service or cultural expectations, opportunity for implicit intent to be shared).

Finally, part D of the assessment tool asked panel members to rate, on a scale of one to ten, the overall utility of the framework for analysing the CC and to identify any aspects of the CC that were not covered by the framework.

Throughout, panel members were requested to amplify their assessments with a short written explanation.

3.4 Procedure for Assessment

In order to ensure a common understanding of the conceptual framework for C^2 , the assessment panel reviewed, in detail, all the documentation concerning the framework. They then attended a one-day training session consisting of a briefing on the framework and the tool by its authors, followed by an opportunity to clarify any areas of conceptual uncertainty. During this session, five command challenges, selected as test cases, were independently assessed by the panel members and the authors and the results compared for consistency.

During the training session, panel members noted that some of the situations involved multiple participants, thus leading to confusion as to which participant was the focus of the assessment. To resolve this confusion, each CC was re-assessed by the panel who reached a consensus on which ones could be viewed from the perspective of the different participants in the situation. They then established what these individual's (henceforth termed the *focal person's*) particular challenge was in each case. These new perspectives provided an additional set of CCs, raising the number of challenges to be evaluated from 50 to 73. Each of the five panel members then independently assessed the 73 challenges using the assessment tool. The results were consolidated into an Access database for analysis.

4. Results

4.1 Frequency of Command Capabilities and Factors

Recall that part A of the framework assessment addressed the extent to which the eight aspects of command capability were involved in the command challenges. A majority² of the panel identified at least one of competency, authority or responsibility as an issue in every CC. Furthermore, the majority agreed that competency played a role in all of the challenges (100%), that authority was involved in 93% and that responsibility was also involved in 93%. Figure 1 shows a breakdown of the command capabilities within each dimension. Note that intellectual competency, legal authority and extrinsic responsibility played a role in a large proportion (at least 74%) of the challenges. Also, all remaining command capabilities, except one, were noted in at least 50% of the situations. The exception was physical competency which was an issue in only 11% of the situations.

The assessment tool listed primary and support factors that were possible issues within each command capability. As shown in figure 2, primary factors associated with the focal person were more often identified than support factors, except in the case of physical competency (which itself was an issue in only a small number of CCs).

² Unless otherwise noted, the criterion for counting capabilities and factors was that a majority of the panel members (i.e., at least 3 out of the five) agree that the capability or factor pertained to the CC.

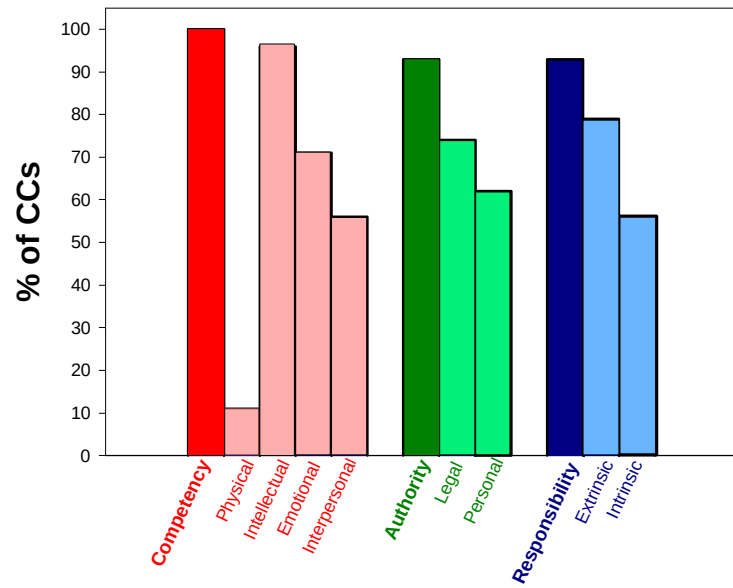


Figure 1: Percent of command challenges involving capability (according to a majority of panel members)

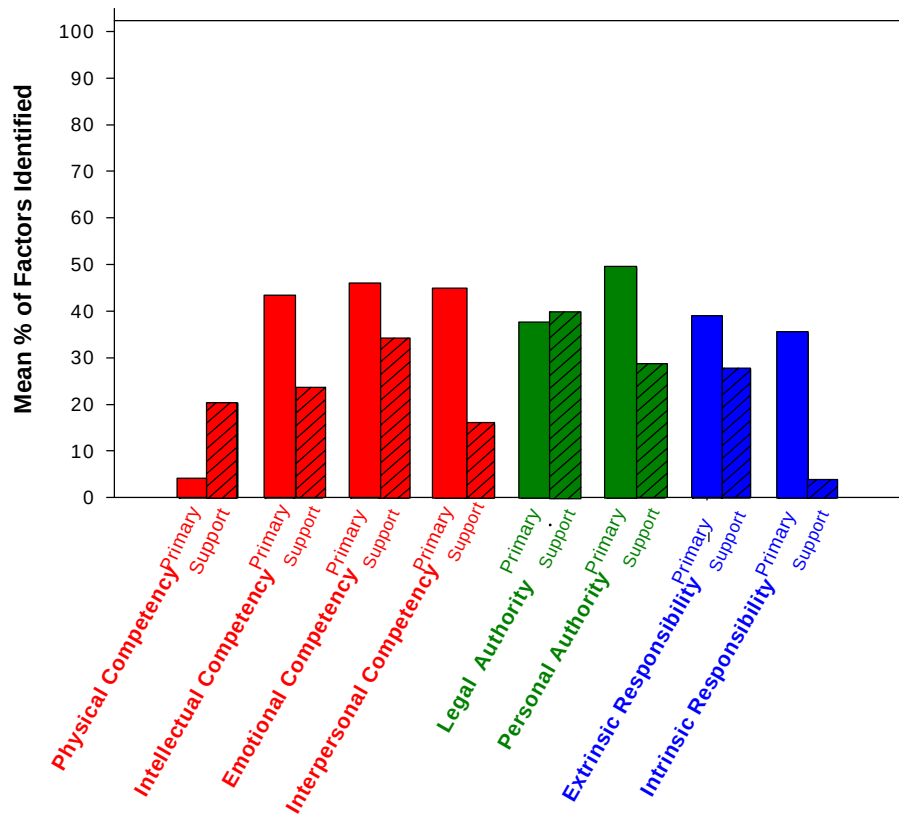


Figure 2: Mean percent of primary versus support factors, by capability

Table 1: Frequency of capabilities cited in the CCs and the breakdown of factors involved

Capability (No. of CCs involving Capability*)	Primary / Support	Factor	Examples	Percent of times factor identified ⁺
Physical Competency (8)	Primary	Sensing	Seeing, hearing	2 %
		Acting	Lifting, running, firing weapons	3 %
		Maintaining	Acute or chronic fatigue, injuries, sickness	4 %
		Experience	Number of tours, range of jobs, years of service	5 %
		Other		1%
	Support	Sensing equipment	Radar, night vision goggles	14 %
		Acting equipment	Weapons, vehicles, bridges	16 %
		Supplies & Support	Food, ammunition, gas, SOPs, maintenance	17 %
		Training	Appropriateness of courses	34 %
		Other		0%
Intellectual Competency (70)	Primary	Situational Awareness	Understanding, too little or too much information	76 %
		Problem Solving	Decision making, time pressure	60 %
		Creativity	Novel solutions, creating new SOPs, changing plans	36 %
		Maintaining	Sleep loss, work/rest cycles, acute stress	12 %
		Experience	Number of tours, range of jobs, years of service	32 %
		Other		2%
	Support	C ² Equipment	Radios, computers, displays, maps	4 %
		Decision Support	Intelligence, advisors, expert systems	37 %
		Procedures	SOPs, ROEs, planning process, approval process	40 %
		Training & Education	Appropriateness of courses	12 %
		Other		1%
Emotional Competency (52)	Primary	Acute Stress	Personal, familial, social, moral, environmental	27 %
		Chronic Stress	Extended acute stress, extended fatigue, op temp	33 %
		Personal Maturity	Appropriate behavior, good judgment	77 %
		Other		3%
	Support	Formal	Chaplaincy, supervisor, medical professionals	22 %
		Informal	Unit morale and cohesion	40 %
		Policies	Compassionate leave, phone calls home, alcohol	40%
		Other		0%
Interpersonal Competency (41)	Primary	Language & Communication	Articulateness, interpretation	38 %
		Opportunity	# of visits, visibility, availability	30 %
		Social Maturity	Empathy, political correctness, tolerance	65 %
		Other		11%
	Support	Communications Methods	Radios, computers, in-person	34 %
		Policies	On talking to media, on touring troops	8 %
		Training	Public speaking, writing, media awareness	5 %
		Other		0%

* In the opinion of a majority of the panel members (greater than 3).

+ Based on N in column 1.

Table 1 (con't):

Capability (No. of CCs involving Capability*)	Primary / Support	Factor	Examples	Percent of times factor identified ⁺
Legal Authority (54)	Primary	Mission Mandate	Non-existent, unrealistic, unclear, changing,	45 %
		Resources	Accessibility, appropriate type of supplies, personnel	38 %
		Rank Level	Rank too high or too low for task	8 %
		Use of Power	Appropriate, inappropriate, consistent	58 %
		Other		2%
	Support	Rules & Regulations	Conflicting, confusing, imprecise, lacking	37 %
		Chain of Command	Ambiguous, multi-national, ineffective	42 %
		Other		1%
Personal Authority (45)	Primary	Influence Up	With peers and superiors in chain of command, HQ	44 %
		Influence Down	With subordinates, NGOs, civilians	70 %
		Appropriateness of Influence	Abuse of trust, degree	34 %
		Other		1%
	Support	Traditions	Regimental system, service traditions	22 %
		Loyalties	To unit, to mission, to service	27 %
		Opportunities	For setting examples, for demonstrating skills	36 %
		Other		0%
Extrinsic Responsibility (58)	Primary	Acceptance/Reticence	Problem ownership, diverting blame	87 %
		Clarity	Moral implications of situation unclear, fuzzy ethos	24 %
		Personal Involvement	Lack of perspective, too involved	18 %
		Trust	Faith in system, in chain of command	25 %
		Other		2%
	Support	Accountabilities	Conflicting, confusing, imprecise, lacking	28 %
		Accountability enforcement	Too lax, too rigid	27 %
		Other		1%
Intrinsic Responsibility (41)	Primary	Motivation	Too much, too little	16 %
		Commitment	To mission, to service, to personnel	53 %
		Pride	Too much, too little	6 %
		Personal Ethics	Moral obligation	66 %
		Other		3%
	Support	Promotion Criteria	Not aligned with organizational values	5 %
		Reward System	Too arbitrary, too few, too many	3 %
		Opportunities for Growth	New skills, degrees, training	3 %
		Other		2%

* In the opinion of a majority of the panel members (greater than 3).

+ Based on N in column 1.

Table 1 shows the percent of times that each factor was noted by the majority of members³. Situation awareness and problem solving ability of the focal person were frequently identified under intellectual competency. Level of maturity of the focal person was an issue in many CCs – either personal maturity (under emotional competency) or social maturity (under interpersonal competency). Mission mandate and the availability of resources to carry out the mission were both implicated (either positively or negatively) as primary factors under legal authority, but the support for legal authority, especially the chain of command, also played a role in many CCs. In terms of personal authority, the principal factor was the influence of the focal person on subordinates, although influence up with superiors was also a frequently identified factor. The willingness to accept responsibility was identified as an issue by most assessors (87%) in the CCs involving extrinsic responsibility. Finally, commitment and personal ethics were frequently named in those CCs involving intrinsic responsibility.

4.2 *Balanced Command*

In 29 of the 73 command challenges (40%), the focal person was judged to be on the Balanced Command Envelope by a majority of the panel members. Table 2 shows how those panel members assessed these 29 cases in terms of the specific balance between competency, authority and responsibility. In the table, the data have been collapsed into 3 categories based on the relationship between authority and responsibility. The “dangerous” category are those cases where authority was assessed by the panel member as being greater than responsibility; the “ineffectual” category includes cases where authority was assessed as being less than responsibility; and the “balanced” category includes cases where authority and responsibility were assessed as being equivalent. These three categories were then crossed with the three possible degrees of competency (“less than adequate”, “adequate” and “more than adequate”). Consistent with the notion of the BCE, the majority of assessments indicated a balance in terms of authority/responsibility, with either an adequate level of competency (67%), or a more than adequate level (11%). There were several assessments of ineffectual authority/responsibility (15% of the total) but almost no cases of dangerous authority/responsibility (only 5%).

Authority/Responsibility Relationship	Degree of Competency		
	Less than adequate	Adequate	More than Adequate
Dangerous	0%	4%	1%
Balanced	1%	67%	11%
Ineffectual	0%	8%	7%

Table 2: Distribution of assessment of competency, authority and responsibility for cases where the focal person was judged to be on the BCE

³ Note that the percentages for each capability do not sum to 100% since more than one factor could be identified for any particular CC by any panel member.

In the remainder of the challenges, with the exception of 5 where consensus was not achieved amongst the assessment panel, the focal person was judged to be off the BCE by a majority of the panel. This occurred in 39 cases (53% of the total of 73). Table 3 shows how panel members judged these cases in terms of the authority/responsibility relationship and degree of competency. Again, consistent with the notion of the BCE, almost no assessments (2%) placed the focal person in balance (i.e., balanced authority/responsibility with adequate competency). Rather, almost in 75% of the assessments the focal person was viewed as having less than adequate competency (i.e., collapsing over authority/responsibility relationship). Furthermore, in half of *these* cases (37% of the assessments), the focal person was placed in the dangerous authority/responsibility region.

Authority/Responsibility Relationship	Degree of Competency		
	Less than adequate	Adequate	More than Adequate
Dangerous	37%	7%	0%
Balanced	22%	2%	3%
Ineffectual	16%	6%	7%

Table 3: Distribution of assessment of competency, authority and responsibility for cases where focal person was judged to be off the BCE

4.3 Common Intent

Issues of common intent were involved in 25 (34%) of the command challenges, based on a

Intent (No. of CCs*)	Factor	Examples	Percent of times factor identified ⁺
Explicit (23)	Aim or purpose	unrealistic, unclear, illegal	96 %
	Language	translations, articulateness	18 %
	Means of Communication	info load, bandwidth, time delays	23 %
	Time	for elaboration, questions, backbriefs	16 %
	Other		5 %
Implicit (15)	Personal Expectations	of a specific individual	69 %
	Service Expectations	army, navy, air force, reserves	56 %
	Cultural Expectations	sex, racial or religious differences	16 %
	National Expectations	coalition forces	24 %
	Opportunity	for socialization	2 %

* In the opinion of a majority of the panel members (greater than 3).

+ Based on N in column 1.

Table 4: Breakdown of frequency of factors associated with intent

majority opinion of the panel. Of these, 23 challenges entailed explicit intent, and 15 entailed implicit intent. As shown in table 4, most of these cases involved either an issue with the (explicit) aim of the mission or an issue of the (implicit) personal or service expectations of those involved in the challenge.

4.4 Overall Utility of the Framework

Panel members felt that, on average, the framework had a high utility for analysing the CCs, with the mean rating of 7.0 (s.d. = 1.1) on a scale of one (low) to ten (high). Furthermore, a score of 6.2 or greater was achieved for 75% of the CCs. Thirteen CCs had a mean rating of less than 6.0; however, these CCs also had a large standard deviation (mean s.d. of these cases was 3.3) indicating a lack of agreement amongst panel members.

Most panel members (i.e., three or more) felt that the framework covered the important aspects of every CC. However, panel members did note some situations that were not addressed adequately, including those where decisions about policy were made, where advice was given (as opposed to action being taken). The framework also does not easily handle situations where there is a difference in the levels of legal and personal authority.

5. Discussion

Overall, the framework provided a strong perspective and good utility for analysing these command challenges. According to panel members, most of the command capabilities were implicated in the CCs, with the exception of physical competency. That physical competency was not frequently identified may reflect the nature of the CCs: most involved officers, many at a senior level, in situations where decision making and judgment rather than physical action was required. Although panel members identified aspects of the CCs that were not adequately addressed by the framework overall, none of the assessment panel identified specific command capabilities that had not been included in the framework. Thus, in terms of the command dimensions, the framework seems to be comprehensive.

The distribution of frequency with which the factors within each capability were identified by the panel members provides some further insight into the capabilities that were in play in these CCs. All of the factors listed in the assessment tool (except those in physical competency) were implicated to some degree in the CCs. However, primary factors were more frequently identified than support factors. This suggests that factors involving the individual (e.g., their knowledge, skill, and personal traits) were prominent in these CCs, a conclusion that is consistent with the importance of the human in command.

The BCE concept is one of the unique features of the framework and the results indicate that it was possible to obtain consistency among the panel members concerning the question of whether or not the focal person was on the BCE (in only 5 of the 73 cases was a majority view not obtained). Furthermore, there was good consistency between the response to this question and the subsequent assessment of the balance between competency, authority and responsibility. The most striking finding was the proportion of times that competency was

identified as the inadequate capability for those CCs where the focal person was judged outside the BCE.

Our experience in this study suggests that we need to better define the content of the CCs that are used in the assessment, in particular by ensuring that only one person is the person in focus (although others would typically be involved) and that some tangible action results. Furthermore, the analysis against the framework would benefit from having an indication of the outcome of the actions taken in the CC – either positive or negative – although the contributors of the current set of CCs were not asked to provide it. Since the framework hypothesizes, in general, that being off the BCE is detrimental to command, these additional data would allow us to test this hypothesis in terms of the outcome of the CC.

Notwithstanding the general agreement concerning the assessments, there were many instances of disagreement concerning particular CCs, in some cases with panel members at opposite ends of the spectrum of opinion (e.g., concerning the BCE). Such cases need to be investigated in more detail to determine the cause of the discrepancy – problems with the CC, mis-interpretation of the assessment question or a problem in the framework itself.

6. Conclusions

This study has described the analysis of a collection of command challenges from the perspective of a new conceptual framework for C². It has demonstrated that, using the framework, we are able to identify consistent command themes arising from the challenges. The study has also confirmed the general validity of the framework for its applicability to real world military situations. With refinement, this framework could assist military policy makers, requirement analysts, training coordinators, boards of inquiry and strategic planners by providing a more consistent and coherent approach for understanding command and control challenges.

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