

Clarifying the Concepts of Control and of Command

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Abstract

This paper builds on our efforts to establish a theoretical base for research in Command and Control. We begin by offering two new definitions of *Command* and *Control* that are radically different from the ones currently used. These definitions are short, internally consistent and functional: Control is *those structures and processes devised by Command to manage risk*; and Command is *the creative expression of human will necessary to accomplish a mission*. The definition of Command emphasises its uniquely human nature, while Control is given a supportive (though still important) role. We then go on to describe those human attributes essential for Command in the context of three Command dimensions: competency, authority and responsibility. We posit that the level of competency, authority and responsibility held by individuals in Command should ideally lie within a *Balanced Command Envelope*, a volume within the Command Space that balances the attributes in the three dimensions. Examples of situations where Command lies outside the Balanced Command Envelope are given and the implications for performance – both positive and negative – are outlined. The paper concludes with a discussion of how Control can support (or hinder) Command.

1. Introduction

This paper builds further on our efforts to understand the fundamental concepts of *Command* and of *Control* and to clarify the relationship between them [Pigeau and McCann, 1995; McCann and Pigeau, 1996; Pigeau and McCann, in press]. Our purpose is to establish a theoretical base for research in Command and Control (C^2), one that will reflect and support C^2 as it is actually practised by the military, as well as permit the formulation of relevant and testable scientific hypotheses. For despite rapid developments in C^2 technology, a solid, comprehensive and productive theory of C^2 that can guide both the military and the research community has been lacking [Foster, 1988].

In our previous work, we have explored the composite term *Command and Control* (i.e., C^2), as defined¹ in military documents and found the definition to be verbose, descriptive and lacking in

¹ The NATO definition of Command and Control is: The exercise of authority and direction by a designated commander over assigned forces in the accomplishment of the force's mission. The functions of command and control are performed through an arrangement of personnel, equipment, communications, facilities and procedures which are employed by a commander in planning, directing, co-ordinating and controlling forces in the accomplishment of his mission. [NATO, 1988]

conceptual guidance [Pigeau and McCann, in press]. Furthermore, we have noted that the heavy emphasis on Control activities (e.g., procedures, algorithms, systems, etc) in this definition undermined the critical role of Command. To rectify this problem, we have proposed a new definition of C^2 , one centred on the very human idea of *intent*:

Command and Control: *The establishment of common intent to achieve co-ordinated action.*

Central to this definition is the concept of establishing intent: the fundamental activity of determining what to do and how to propagate it among subordinates. The concept is broader than simple decision-making. It requires a creative act whose purpose is to bound an infinitely large space of possible actions into a finite number of precise, focused objectives. Intent embodies a human commander's vision and will, and is inevitably the product of history, expertise and circumstance². We have argued that our new definition is more comprehensive and universal than the standard military definition, while at the same time cutting succinctly to the essence of the C^2 concept itself. Furthermore, it makes provision for the goals and activities of teams as well as single individuals.

However, when we first developed this new definition of C^2 we knew that it had to be consistent (but not redundant) with the more fundamental and separate concepts of Command and of Control. In Pigeau and McCann [1995] we discursively explored the difference between the two concepts. We observed that Command is associated with authority, responsibility, initiative, courage, trust and leadership and we concluded that Command is therefore a uniquely human activity. Control, by contrast, is associated with plans, procedures, rules of engagement, communications protocols, software, and equipment. We asserted that Command and Control have complementary roles in C^2 , but that they are not equal: Control is a tool of Command. Furthermore, Command has two special functions that give it precedence over Control. First, Command initiates Control. Control cannot happen without there having first been at least one instance of Command – that is, at least one goal established and one decision to act made by at least one individual in a position of authority. Second, and far more importantly, Command is capable of changing Control – that is, dynamically altering existing Control structures and processes to suit the unanticipated needs and priorities of a particular mission.

This paper further develops and refines our ideas on these two critical concepts. It begins by offering a new definition of Command and a new definition of Control. Since our argument stresses the fundamental importance and priority of Command, we spend the bulk of the paper describing three dimensions of Command that comprehensively account for the necessary attributes of Command. This is followed by the introduction of a new concept called the Balanced Command Envelope, within which ideal Command resides. The paper concludes with a discussion of how Control can support Command in each of the three Command dimensions.

We begin by articulating precise answers to the following two questions: What is Control? and What is Command?

² For a detailed discussion of intent, common intent, and the implications of those concepts from the perspective of military organizational structure and leadership, see Pigeau and McCann [in press].

2. Defining “Command” and “Control”

In our previous work, we offered the following defence for dwelling on definitions:

Definitions are not merely rhetorical devices used by ivory-tower intellectuals for arguing the finer points of semantics. A definition, when properly constructed, should concisely embody the essence of a concept, giving it significance and precise meaning, encapsulating its nature and key qualities. A definition provides an authoritative anchor for deriving new ideas and interpretations. It should be neither ambiguous nor redundant; nor should it be simply descriptive. [Pigeau and McCann, in press]

In our opinion, none of the existing definitions of “Command” and “Control” satisfies these criteria. They are circular, lengthy, descriptive, and furthermore, provide little guidance for research. Although militaries around the world seem to have been able to function despite the definitional vagueness and confusion of these concepts – and this says much about human resourcefulness and flexibility – we believe that this confusion has fragmented and inhibited C^2 research and has stymied C^2 systems acquisition. In an attempt to rectify this problem, we have spent the last four years researching the concepts of Command and Control, reviewing the literature, and conferring with military commanders and our research colleagues, particularly those who attended a recent international workshop on *The Human in Command*. Based on this effort, we have developed new definitions of Command and Control, ones that we feel are short, internally consistent and functional, both for the military and for the research community.

2.1 Control

Control is, first and foremost, the attempt to reduce and manage uncertainty in the military domain. Uncertainty clouds a comprehensive and accurate view of the problem, it hinders the identification of possible solutions and, eventually, it jeopardises the accomplishment of the mission. As we have noted previously, there are two main sources of uncertainty in C^2 : the physical environment (e.g., the weather), and the actions of humans (both own forces and the adversary). Although these uncertainties can never be completely eliminated, the use of a Control system that can systematically gather and organise information about the environment, own resources and the adversary can significantly reduce them.

Control reduces uncertainty by applying structures and processes to bound the problem space, making it more manageable. Structures are frameworks of interrelated concepts (or physical objects) that define and classify some larger entity. For example a bridge is a structure of interrelated objects (e.g., girders, cables, trusses, etc) that defines an entity for spanning spaces. An organisation is a structure of interrelated departments (e.g., personnel, administration, production, etc) that defines an entity for providing some product or service. At a more abstract level, language is a structure of interrelated components (e.g., subjects, predicates, verbs, nouns, etc) for defining a form of communication. In a universe where there may exist an infinite number of ways for spanning spaces, producing products or communicating meanings, the structures “bridge”, “organisation” and “language” immediately reduce the space for describing problems to a smaller, more manageable size and, by doing so, offer a more restricted set of solutions.

Similarly, military Control encompasses a host of structures for bounding the mission space – e.g., chain of command, order of battle, databases for describing terrain, weapon systems, etc.

Control processes, on the other hand, are sets of regulated procedures that allow Control structures to perform work³. They are mechanisms for invoking and controlling action. Military rules of engagement, for example, are formal processes for regulating the use of power – for specifying the way in which military structures (e.g., soldiers, battle groups, and squadrons) achieve their objective. In one sense, Control processes themselves can be viewed simply as higher level structures that encompass interrelated sub-structures, which dynamically change through time. The point is that both structures and processes provide ways for Control to reduce the problem space – and hence uncertainty – and to identify, as well as undertake courses of action to mitigate the risk of mission failure.

A major result of Control, besides problem space reduction, is the increase in speed of response to events in the environment. The reduction of uncertainty implies an increase in order; increased order offers a rational basis for choosing and then optimising appropriate courses of action. Indeed, a good Control system should try to accomplish its goals faster than those of the adversary in order to force the adversary into a responsive and reactive position. This, in turn, reduces uncertainty and risk still further by controlling the adversary's actions – by getting inside her decision cycle.

In short, then, Control's principle contribution to C² is to reduce and manage the mission problem in order to minimise the risk of not achieving a satisfactory solution. With this conclusion in mind, we are now in a position to formally define Control.

Control: *Those structures and processes devised by Command to manage risk.*

Besides being substantially shorter than the current definition of Control⁴ this new definition emphasises the three essential aspects of the concept. First, it states that the primary aim of Control is to manage risk – risks derived from domain uncertainty, alternative courses of action and response time. Second, it asserts that Control accomplishes risk management through the application of structures and processes. Finally, the definition explicitly states that Control is devised through Command – that all Control structures and processes must first be developed and implemented by Command. In our opinion, this is a key aspect of the definition. It implies that the definition itself is incomplete without a reference to Command; that Control must ultimately *depend* on Command. All militaries agree that the C² “buck” stops at the human, at the commander. Command alone has the responsibility for the mission.

³ Control structures and processes differ in their degree of formality and rigidity (i.e., structure), ranging from the high rigidity of equipment and software; through plans and rules of engagement; to organisational structure and doctrine, the latter having somewhat more flexibility. See Pigeau and McCann [1995] for a more extensive description of Control structure and process within C².

⁴ The NATO definition of Control is: That authority exercised by a commander over part of the activities of subordinate organisations, or other organisations not normally under his command which encompasses the responsibility for implementing orders or directives. [NATO, 1988]

Control manages risk through structure and process. But where do these structures and processes come from? The answer is contained in the definition: from Command. We now turn to the definition of this elusive but critical concept.

2.2 *Command*

We define Command as:

Command: *The creative expression of human will necessary to accomplish a mission.*

At first blush this definition may seem simplistic, imprecise or lacking in detail; but this is not the case. This definition captures the essence of Command without resorting to long-winded description. It identifies those critical aspects of Command that befit the importance of the concept itself. The most important of these is the human.

The assertion that Command is first and foremost a human endeavour is fully supported by military scholarship [e.g., Hays and Thomas, 1967] and doctrine [e.g., Canada, 1998]. Canadian doctrine (as well as British and American) highlights uniquely human characteristics when delineating the qualities of Command – for example, courage, leadership, vision, judgement, initiative and self-confidence. Pre-eminent among these human characteristics is responsibility, a “fundamental concept of command” [United Kingdom, 1995, p. 1-3]. Responsibility is a capacity that can *only* be attributed to the human. In further support of this position, Keegan’s [1976] treatise on *The Face of Battle* alludes to the fundamental human nature of battle:

[Battle is]... not something ‘strategic’, nor ‘tactical’, nor material, nor technical... What battles have in common is human: the behaviour of men struggling to reconcile their instinct for self-preservation, their sense of honour and the achievement of some aim over which other men are ready to kill them. [p. 297]

Implied in Keegan’s “sense of honour” is the exclusive human capacity for *caring* – caring for one’s mission, nation, and family. Therefore to exclude the human from the definition of Command – to exclude notions of valour, loyalty, duty, etc – would result in *dehumanising* (literally) the concept. We realise, however, that simply equating Command with human capability is not sufficient to elucidate the concept for either the military or the research communities. Three other important concepts are included in our definition: *will*, *creativity* and *mission*.

Will involves the faculty to arrive at one’s own decision as well as the determination to act upon it, in spite of opposition. It is an attribute that has been pivotal in many descriptions and discussions of Command. For example, Field Marshall Montgomery viewed Command as “the capacity and the will to rally men and women to a common purpose and the character which inspires confidence.” [Montgomery, 1958, p. 80]. Also, in the keynote speech at the workshop on *The Human in Command*, LGen Raymond Crabbe stated:

If there was one characteristic of command that I believed must be ever present, it was the will to get the job done, to see an action through to its successful conclusion, to be resolute. The ability to overcome obstacles and impediments and get to

the objective, to remain focussed on the mission ... ensuring that impediments do not become showstoppers. [Crabbe, in press]

Will captures the critical notions of purposefulness, diligence, decision-making and resolve in military operations. Human will, furthermore, is the source of Command intent⁵ and provides the basis for “the establishment of common intent” – a central focus of our definition of C^2 . When Command expresses its will, it provides, among other things, the “initial conditions” to start and sustain Control. It gives those structures and processes that constitute Control the criteria for bounding the military problem space and efficiently invoking action.

But where do these initial conditions, as expressed by human will, come from? Moreover, how were the structures and processes of Control originally conceived, and how can they be changed dynamically during the course of an operation? Control structures and processes, no matter how comprehensive and detailed, can never accommodate all of the uncertainties in military missions. Command must adapt them, must change them, but more importantly, it must *create* them. Creativity, a hallmark of human cognitive behaviour, is indispensable for Command. If Command cannot, on occasion, come up with novel solutions to problems, if it cannot identify new patterns of behaviour in the adversary or in the environment and create equally new responses to them, then C^2 will fail. In fact, the entire concept of “asymmetric threat” assumes that there are novel (and simple) solutions for undermining sophisticated Control mechanisms. An asymmetric threat is a direct manifestation of the creative use of Command. Though it is beyond the scope of this paper to discuss the nature of creativity, its importance for Command must not be underestimated.

Finally, our definition of Command stresses that “the creative expression of human will” is in the service of “a mission”. Command must be goal oriented. Missions may be externally generated (e.g., from the military’s government) or they may be generated internally by Command itself; regardless, the mission allows militaries to operate in context.

3. The Dimensions of Command

Our definition of Command implies that it is a uniquely human characteristic. It follows, therefore, that all humans in military organisations have the potential to Command. From the most junior private to the most senior general officer, all individuals can creatively express their will to accomplish a mission – as is illustrated by the following incident recorded in a historical memorandum:

Pte Haggard now took charge of the situation, in the absence of leadership from any NCO... With the help of Pte Berthelot, a Bren gunner, Pte Haggard now organized an attack on [a] position... which was subsequently found to have been held by about 50 [enemy soldiers] with four machine-guns. [Memorandum, Historical officer at Canadian Military HQ at Dieppe, 1942]

If the potential for Command is ubiquitous among all humans, then what differentiates the capability and expression of Command? What determines the “degree” of Command within an indi-

⁵ For example, will is also defined as “deliberate intention”.

vidual? What sets the general officer apart from the private? We posit that there are three principal attributes that, when combined and expressed, predict the likelihood and impact of Command. These three qualities (or dimensions) of Command are: *competency*, *authority* and *responsibility*.

3.1 *Competency*

Effective Command requires that individuals possess skill sets and abilities in order to accomplish missions. For most militaries, *physical competency* is one of the most fundamental and is mandatory for almost any operational task, from conducting a ground reconnaissance, to loading a weapon, to flying a helicopter. However, physical competency is not limited to physical strength, it also involves (often sophisticated) sensory motor skills, health, agility, and endurance. *Intellectual competency* is critical for planning missions, monitoring the situation, reasoning, making inferences, visualizing the problem space, assessing risks and making judgements. Above all, since no two missions are ever the same, intellectual competency must include creativity, flexibility and a willingness to learn.

The importance of physical and intellectual competency for Command is well recognized. Most militaries institute physical and intellectual aptitude testing at recruitment and then follow this by extensive physical and intellectual training through basic training, then later still with specialist courses and staff colleges to develop these competencies. However, there are other less obvious but equally important competencies for Command – competencies that are not explicitly trained or formally acknowledged.

Military life is rigorous and stressful. Missions (especially in Operations Other Than War) can be ill-defined, operational environments uncertain, resources scarce and stakes high. Also, deployments are usually disruptive to family life and stability. To Command under these trying conditions requires significant *emotional competency*, a competency strongly associated with resilience, hardiness and the ability to cope under stress. Command decisions are made under operational conditions often demanding a degree of emotional “toughness”, especially in accepting the consequences of the (inevitable) risks in an operation and in being able to maturely assess subordinates’ capabilities, as well as one’s own. The ability to keep an overall emotional balance and a perspective on the situation is critical, as is a sense of humour.

Finally, because Command inevitably involves dealing with people, whether it be one’s subordinates, peers or superiors, it requires a high degree of *interpersonal competency*. Social skills, developed throughout childhood, are the basis for this competency, which develops to include attributes of trust, respect and empathy that promote effective teamwork. Interpersonal interactions require an ability to articulate one’s thoughts, ideas and vision, especially verbally, but also in writing. Ultimately, Command demands leadership skills – the potential to motivate others, resolve conflicts in intent, and inspire common purpose.

In summary, then, we have identified an extensive set of personal attributes falling into four general categories – physical, intellectual, emotional and interpersonal – that we believe contribute to the competency dimension of Command.

3.2 Authority

Authority, the second dimension of Command, refers to its domain of influence. It is the degree to which Command is empowered to act, the scope of its power and the extent of the resources at its disposal for enacting its will. The importance of authority is reflected in the existing NATO definition of Command, which identifies it exclusively with authority⁶. We distinguish between the Command authority that is designated from external sources and that which an individual earns by virtue of her personal credibility – that is, between *legal authority* and *personal authority*.

Legal authority is the power to act that is assigned by an external agency, typically the government. It is designated constitutionally and through legislation, and thus it is explicit, formal and (relatively) static. Legal authority assigns Command resources and personnel and gives the right to use them in the accomplishment of a mission. Furthermore, it allocates special powers, unique to the military – for example the authority to enforce obedience. Legal authority is a function of rank and position.

Personal authority, on the other hand, is that authority given by peers and subordinates. Personal authority resides primarily at a tacit level, rather than being explicit like legal authority. It is earned over time based on reputation, experience and character, and is often acquired through personal example, as illustrated in the following quote from Gen. Matthew Ridgway:

I held to the old-fashioned idea that it helped the spirits of the men to see the Old Man up there, in the snow and sleet and the mud, sharing the same cold, miserable existence they had to endure. [Schnabel, 1964, p. 9]

The degree of personal authority achieved by an individual is correlated to some extent with professional knowledge (i.e., competency). However, an individual's ethics, values, courage (both physical and moral), and integrity form the more critical basis for personal authority.

Although legal authority is an essential component of Command for most militaries, in some organisations – for example guerrilla groups, para-militaries, cults – Command authority is achieved almost exclusively through personal authority. In these cases, Command can be flexible, albeit perhaps arbitrary and idiosyncratic. By contrast, when an individual has been given the legal authority to Command but hasn't had the opportunity (or doesn't have the ability or inclination) to establish personal authority, Command is relatively limited and rigid, since the authority is based solely on formal mechanisms. Command authority is optimal when there is both legal authority to endow formal power and personal authority to provide a motivating exemplar.

3.3 Responsibility

The third dimension of Command is responsibility. This dimension addresses the degree to which an individual accepts the moral liability and obligation commensurate with Command. As

⁶ The NATO definition of Command is: The authority vested in an individual of the armed forces for the direction, co-ordination, and control of military forces. [NATO, 1988]

with authority, there are two components to responsibility, one that can be publicly formulated, and the other that is internally generated. The first, which we will call *extrinsic responsibility*, involves the formal obligation to answer publicly for the assignment of legal authority. Extrinsic responsibility is equivalent to accountability. Legal authority and extrinsic responsibility therefore, are complementary: there is a commensurate expectation of accountability when legal authority is assigned. But as section 5 will discuss, these components are not always correlated.

Intrinsic responsibility, the second component, is the degree of self-generated obligation that one feels about the mission. It is a function of the resolve and motivation an individual brings to a problem – the amount of ownership taken and the amount of commitment expressed. Intrinsic responsibility is associated with the concepts of honour, loyalty and duty, which are timeless qualities linked to military ethics. Of all the components in the dimensions of Command, intrinsic responsibility is the most pivotal, for three reasons. First, intrinsic responsibility provides the ultimate source of the *will* that we assert is essential for Command. Second, it is the source of initiative that links Command will to Control action. Third, and finally, this component is the most ephemeral and most difficult to achieve in Command. It is unique to the human.

4. Balanced Command Envelope

We have proposed that the degree of Command capability attributed to an individual can be measured as a function of the three dimensions of competency, authority and responsibility. We now further assert that these dimensions are sufficient to account for Command capability, that Command is a function of these three dimensions alone. Together, they form an abstract three-dimensional space within which the Command potential of all military personnel lie. This *Command Space* is shown in Figure 1.

Furthermore, from the literature, as well as from our observations and discussions with commanders, we note that there is a correlation among the Command dimensions. For instance, the assignment of legal authority anticipates a commensurate level of accountability (extrinsic responsibility) and an adequate level of competency to exercise the authority. Additional personal authority can be gained when competency is high (e.g., intellectual proficiency, verbal articulateness) and evidence of intrinsic responsibility (e.g, resolve, initiative) is strong. In general, high levels of Command authority are typically associated with high levels of competency and commensurately high levels of responsibility (typical of senior officers and NCOs). Lower competency, on the other hand, is associated with lower authority and responsibility (typical of junior military personnel). We posit that there exists a roughly linear⁷ relationship among the three dimensions, one that reflects an *optimal* balance for different levels of Command. This relationship delineates a hypothesised *Balanced Command Envelope (BCE)* within which a military organisation should ensure its personnel reside (Figure 1). The BCE is reflected in the rank structure of the military, as well as the experience of its members.

It follows, therefore, that those individuals whose Command capability lies outside the Balanced Command Envelope – i.e., in whom competency, authority and/or responsibility are not commensurately represented – run the risk of compromised Command capability. We posit that it is

⁷ The exact nature of the relationship is an empirical question.

to the military's benefit to ensure that most of its personnel reside in the BCE. The next section discusses instances of imbalances in the Command dimensions and their implications.

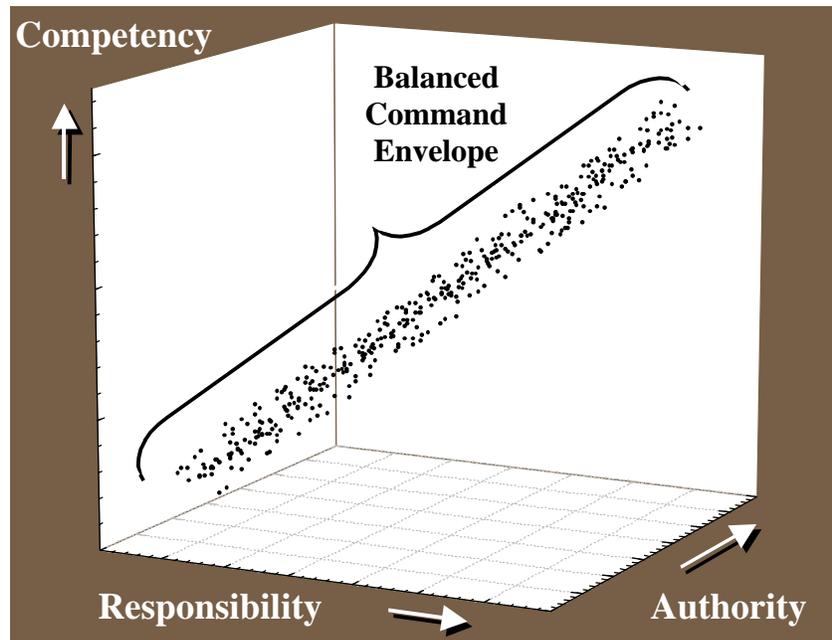


Figure 1. Balanced Command Envelope

5. Imbalances in the Command Dimensions

Consider first a possible misalignment in competency. In contemporary militaries, members of junior ranks often have skills and knowledge (as reflected in their higher levels of education) greater than the authority and responsibility typically accorded to them. For example, Col. Mike Capstick has commented that:

Today's soldier is older and better educated than his Second World War counterpart. Most are married, have children and are more than capable of making their own decisions – they expect and demand that their experience, expertise, and professionalism be respected. [Capstick, in press]

We would predict that a misalignment in competency of this type will result in boredom, lack of initiative and discontentment. If ignored by the military organisation, this imbalance may then lower intrinsic responsibility as a consequence and thus make the Command imbalance greater.

Alternatively, a senior individual with significant levels of authority and responsibility could lose competency as a result of post-traumatic stress due to a difficult operational deployment, or perhaps after receiving a debilitating physical wound. Although this person might still have the motivation and expertise for Command, she would not be able to use those abilities effectively. Her situation would place her outside the Balanced Command Envelope, necessitating effort by both her and the military organisation to rectify the problem and re-establish Command potential.

A third example involves the assignment of an individual to a new position that has more authority and responsibility than her current level of competency. This sometimes occurs when training lags the assignment to a position or if an entirely new kind of competency is required for the position (e.g., dealing with the media, developing negotiation skills, or working as part of a joint force in a different culture). LGen. Romeo Dallaire [in press] and others have noted that peace support operations in remote nations often demand cultural and linguistic skills that are not currently provided in officer training. Therefore as militaries undertake a greater range of operations (e.g., OOTW) they must be sensitive to these kinds of shortfalls in competency – and the resulting imbalances in Command – and pro-actively institute compensatory training and education.

Of course, not all deviations from the Balanced Command Envelope are necessarily bad. Consider the case where a person has acquired increased Command competency (through reading, or extra coursework) and now has greater competency than her current level of Command authority and responsibility requires. If this increase in competency is acknowledged by the military organisation, this person might be promoted to a new position with authority and responsibility commensurate with that new competency. However, should this individual not gain the recognition that she feels she now deserves, her motivation (intrinsic responsibility) may diminish and Command capability may then be compromised.

Thus far our discussion has concentrated on deviations in only one of the three Command dimensions (i.e., competency). Outliers can occur in the other dimensions as well. If an individual is unexpectedly placed in an acting position, this person may not have the competency commensurate with the new level of legal authority. This level of authority might also be incommensurate with the level of responsibility they are willing to accept. The ‘baptism by fire’ that results in this situation can be quite stressful and although it may motivate some individuals to succeed, it can destroy the confidence of others. Another (opposite) example is the case where an officer is posted to a position of reduced authority after serving in a position where she had wielded extensive authority over personnel and resources – for example a move from an operational position to a staff position, a move that generally reduces authority for personnel. Though the posting in no way implies a demotion, the individual may nonetheless have difficulty adapting to this reduction in scope of authority, as it diminishes the overall extent of her Command.

Finally, let us consider misalignments in Command responsibility. Individuals sometimes assume more intrinsic (i.e., personal) responsibility for their activities than the organization expects, given their level of authority. This high intrinsic responsibility can motivate the acquisition of new Command competencies (say, some kind of technical skill). Coupled with the existing augmented sense of responsibility, this may then lead to greater credibility and augmented personal authority, as others in the organization acknowledge the individual’s commitment and increased competence.

Sometimes, however, higher levels of intrinsic responsibility lead to extreme frustration and severe stress. The Dutch Military Academy in Breda, for example, carried out an analysis of the 2nd Dutch Battalion’s difficult command situation in the enclave of Srebrenica in the Former Republic of Yugoslavia [Vogelaar, in press]. The study noted that the severe plight of the in-

habitants in the enclave engendered a personal sense of responsibility on the part of the soldiers serving with battalion. Moved by the appalling living conditions and the severe food shortages being suffered by the inhabitants, the soldiers felt a personal commitment to help them. Yet they had neither the authority nor the resources to assist. Day after day they stood by helpless and frustrated, and the result was that many experienced chronic stress.

At the opposite end of the spectrum is the reduction in the sense of responsibility that can be induced, for example, from the organizational level. Downsizing and rapid organizational change – or the reverse, organizational stagnation – can cause diminished intrinsic responsibility among personnel, resulting in loss of initiative and under-achievement.

The examples we have presented as instances of Command lying outside of the Balanced Command Envelope have been simplified. Rarely do these misalignments occur in isolation (i.e., in one dimension only). More often they interact dynamically, with the individual components acting at times as buffers limiting further misalignment and at other times to reinforce the imbalance and create Command crises. We hypothesise that imbalances and misalignments in the three Command dimensions will create tensions that can adversely affect Command effectiveness and potential if ignored. Therefore military organisations should, ideally, strive to keep their members within the Balanced Command Envelope. Furthermore, the particular characteristics of the employment environment in most modern militaries highlights the importance of maintaining redundancy inside the BCE. For the most part, militaries are self-contained organisations that must recruit, train and educate their own members, often at tremendous cost. When a senior officer resigns or is lost, the organisation cannot simply put a job ad in the local newspaper, nor can it hire a senior officer from another military to compensate the loss, as is common in the private sector. If there is no redundancy within the BCE, the military is faced with moving an individual into the vacant position who will not have the desired balance among the three Command dimensions. Militaries, therefore, cannot afford to be lean organisations. Since they demand unique Command capabilities from their members, they must make a long term investment in developing and maintaining Command potential.

We will conclude this paper by exploring how the concept of a Balanced Command Envelope, as embedded in the space of the three Command dimensions, could be used to assess how Control either supports or hinders Command – that is, how Control's structures and processes can contribute to the alignment or misalignment of competency, authority, and responsibility.

6. The Relationship between Control and Command

We have argued that the role of Control is to effect the will of Command by making use of structures and processes for managing risk⁸. We have further proposed that Command itself can be situated within a three dimensional space of competency, authority and responsibility – in other words, that the attributes necessary for *creatively expressing human will* are contained within this space. We hypothesise, therefore, that Control can support Command only to the extent that Control facilitates Command competency (physical, intellectual, emotional and interper-

⁸ Indeed, the assumption behind the introduction of any new Control system is that its implementation will improve C² effectiveness and thus improve the likelihood of mission success. Note however, that this assumption often remains unverified: changes to C² systems are usually not rigorously evaluated, especially in terms of their effect on Command.

sonal), authority (legal and personal) and responsibility (extrinsic and intrinsic). Let us now consider examples of how Control structure and process can support (or hinder) the three individual dimensions of Command.

6.1 Control and Competency

Typically, a new Control structure or process is introduced with the intention of improving some aspect of physical and intellectual competency. In fact, until recently, augmenting and extending human physical competency was the dominant theme of most system developments – e.g., weapons systems with longer ranges and increased fire power; sensor systems with broader spectrums and better resolution. Today, however, the focus is on enhancing intellectual competency, primarily through information processing technologies. These technologies can extend Command memory, reasoning power and expertise⁹ and assist in the visualisation and assessment of possible courses of action through simulation.

This assumes, of course, that these Control systems are well designed. The reality is that some Control systems are so poorly conceived and implemented that they fail to facilitate Command competency. Complaints about overly-complicated systems, poor user interfaces and lack of flexibility are all manifestations of poorly designed Control systems. Even worse, such systems can have negative secondary effects such as causing user fatigue, or unduly narrowing Command perspective and creativity by inducing a form of mental “tunnel vision”. These kinds of failures in Control systems design have, of course, formed the complaint of human factors engineers for decades.

Regardless of whether Control systems are well developed or not, they are almost exclusively oriented towards improving physical or intellectual competency. Rarely are structures and processes developed to support the emotional and interpersonal competencies of Command. However, the technologies of Control tend to isolate individuals; they focus the individual’s attention on what technology most easily provides – i.e., information – rather than on other people. An area ripe for research is to determine new ways for Control to compensate for this isolation, to facilitate and support emotional competency (e.g., through high bandwidth channels transmitting anger, humour, concern) and interpersonal competency (e.g., through common displays).

6.2 Control and Authority

Although not usually conceived as doing so, some Control structures and processes directly support Command authority. One simple example is a software system for managing access to sensitive information or to weapons systems (implemented through passwords, fingerprint recognition, etc.). An example at a much higher level is government legislation¹⁰ that explicitly outlines the authority of the military organisation as a whole – its domain of influence, power and resources, as well as the authority that individual members can exercise during war. Rules of engagement (ROEs), another type of Control, are intended to define the limited authority of an individual on a case-by-case basis in Operations Other Than War. Recently, ROEs have been

⁹ One of the major benefits of these technologies is to provide a “corporate memory”, a repository of solutions that have been successful in the past. They also provide facilities for the sharing of expertise (e.g., through the Internet).

¹⁰ In Canada, this legislation is the Queen’s Own Orders.

implemented as lists of written rules that soldiers carry on a card in their pockets. However, this Control procedure has been known to fail in stressful situations, since soldiers are rarely trained sufficiently to be able to respond immediately according to the ROE.

Personal authority can be compromised by technology intended to enhance competency. Several military speakers at the *Human in Command* workshop emphasised the importance of maintaining Command presence well forward in the battle space, where the action is taking place. They expressed concern that the current trend to centralise and locate information handling facilities (e.g., intelligence analysis) behind the lines will have the negative side-effect of keeping Command attention back at headquarters, rather than forward with the troops, thus reducing the opportunities to establish personal authority.

Finally, an automated weapon system is an example of a technology that can confuse the lines of legal authority. Once a commander gives an order to carry out the pre-programmed sequence of actions in such a weapon, the system potentially has the power to automatically change the course of a ship, the characteristics of weapons, and even fire weapons without further human intervention. Where does legal authority lie with such a system? Does it reside with the commander, the system designer, or possibly the company who built the control system?

6.3 Control and Responsibility

The acceptance of responsibility is a uniquely human (i.e., Command) characteristic. Control systems will never have “responsibility algorithms” built into them. Nonetheless, Control can influence the degree of accountability and personal responsibility that individuals are willing to take. For example, Control can provide clear terms of reference for aiding Command’s understanding of its accountability (i.e., extrinsic responsibility). Or it can provide a structure for demarcating legal authority and default lines of accountability, as in the chain of command. Where Control has not been terribly helpful, however, is in supporting intrinsic responsibility – the responsibility that individuals bring to their position naturally, because of professional or personal pride. In fact, sophisticated Control technologies sometimes encourage an abdication of responsibility due to their complexity: when an error occurs, a typical reaction in this situation is “It’s the system’s fault.” And finally, as we have argued elsewhere [McCann and Pigeau, 1996], over-control and inflexibility can reduce motivation and initiative.

6.4 Accounting for the Effects of Control

The reader may have noted that Control facilitates some aspects of the Command dimensions more than others. For example, we have mentioned that Control structures and processes are developed primarily to increase physical and intellectual competency but not emotional or interpersonal competency. Similarly, Control supports the clarification of legal authority but leaves the establishment of personal authority up to the individual. And lastly, although extrinsic responsibility (i.e., accountability) can be facilitated by rules and regulations, Control does not facilitate intrinsic responsibility. As a result, only half of the essential Command components are explicitly supported by Control¹¹, while the other half are neglected. Even worse, Control systems implemented to support one component of Command can have a negative impact on one or more of

¹¹ And as we have mentioned, even these components are not supported very well from a human factors perspective.

the other (unsupported) components. The creation and development of comprehensive and successful Control support is much more complicated than most systems designers may believe.

Our notion of the Balanced Command Envelope may help address this problem. The BCE suggests that it is important to maintain a balance among the three dimensions of Command – that a disproportionate increase or decrease in one or more dimensions may have the undesirable consequence of moving individuals outside the BCE. We recommend that the military should assess every proposed change to Control (at the conceptual level) for effects (both positive and negative) on *all* Command components. This assessment could take the form of a decision tree (or checklist) of questions that must be answered before a new Control system is implemented. We are presently in the process of creating such a decision tree and it will be presented at a later date. We anticipate that it will take the form of a matrix of questions concerning support for each component and sub-component of Command, with the answers being rated on a scale and then summed for each of the Command dimensions. Although the validity of this approach must be empirically verified, we hope that this kind of assessment will at least raise the awareness of the need to consider the multiple dimensions of Command.

7. Conclusion

The old definitions of Command, Control and C^2 have offered little assistance to either the military or to the research community. Considering the fundamental importance of these concepts, it is alarming that there has been, historically, such an “an inchoate level of conceptual development” (Foster, 1988) in the area. In our opinion, one reason for this state of affairs is the continual re-interpretation of C^2 within the context of each new technological development – whether it be a new sensor suite, communication device or information management system. In effect, C^2 has been unknowingly re-defining itself with each new technology discovery. The result has been a fragmentation of C^2 , one that has placed it in the unenviable position of being reactive rather than proactive to new developments in the field.

By firmly grounding our definitions in the most important component of C^2 , the human, and by interpreting all other aspects of C^2 as supportive and facilitating tools for the human, we have produced a consistent and functional set of definitions of the area. These definitions have proved useful for delineating the Command space, for deducing the concept of a Balanced Command Envelope, for establishing an unambiguous relationship between Command and Control, and for introducing the far reaching concept of common intent. Although not the final word on this topic, we feel that these definitions do provide at least the beginnings of a theory for C^2 .

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