

Description of Maturity Levels for NNEC C2

Introduction

1. We first need to introduce a number of ideas and terms that will help us (1) define a set of maturity levels for NNEC Command and Control (C2), and (2) describe the key aspects that differentiate between one such level and the next.
2. The operational context involves a coalition force that is composed of a number of “contributing elements,” both military and civilian (inter-agency or whole of government) from the various NATO nations. This coalition will likely include contributions from non-NATO countries and international organizations as well as non-governmental organizations (NGOs) and private voluntary organizations (PVOs). The heterogeneous make-up of the enterprise implies that no single element is “in charge” of the entire endeavor. The interactions between and among these contributing elements need to be considered in terms of the Physical, Information, Cognitive and Social domains (ref SAS-050 [2] and other sources).
3. Industrial Age Command and Control was well matched to the predominant challenges of the Industrial Age. The low agility of the Command process matched the characteristics of the mission environment; specifically the familiarity of the mission, the linearity of the battlespace, the predictability of actions and effects, and its relatively small rate of change (i.e., modestly dynamic).
4. Hence, Industrial Age approaches to Command and Control have proven to be successful in simple, linear (albeit highly complicated) environments where manoeuvre was limited and the concepts of operation employed were based on massed forces to create attrition-based effects. “Industrial” approaches to Command and Control begin to break down in more complex environments where interactions that take place are less linear, more dynamic, and less predictable.
5. This is the nature of the twenty-first century endeavors that require civil-military coalitions. These complex endeavors have to be addressed by increased *command agility* [1]. This requires a number of capabilities that include increased information sharing and increased shared awareness, both of which in turn require progressive enrichment of peer-to-peer (P2P) interactions (e.g., “horizontal” exchanges and interactions with peer contributing force elements and other actors). These peer-to-peer interactions add to the well-established “vertical” interactions present in the command hierarchies.
6. As the maturity level of C2 increases, one or more characteristics of the approach to Command and Control change. This results in approaches to Command and Control that correspond to a given level of maturity being located in different parts of the C2 approach space.¹ For example, one of the dimensions of the C2 approach space represents the

¹ NATO SAS-050, “Final Report: Exploring New Command and Control Concepts and Capabilities” (January 2006). <http://www.dodccrp.org/files/SAS-050%20Final%20Report.pdf>

nature of the interactions between and among participants (in this case, the contributing elements and the individuals and groups of individuals including organizations that comprise them). As the maturity of C2 increases, the frequency of interactions between and among the entities increases and their focus shifts from the Information domain (from sparse to rich exchange of information) to the Cognitive domain (from low to high degrees of shared awareness) and then to the Social domain (from low to high sharing of resources). These are the key “tipping points” leading to qualitatively different NNEC C2 maturity levels. The net result is that entities have the ability to work more closely together as the maturity of C2 increases. Finally, it should be noted that each C2 maturity level incorporates the ability to operate at any one of the maturity levels below it, offering the enterprise a choice.

Aim

7. The aim of this paper is to describe the maturity levels of NNEC C2 and the key requirements for transition from one level to the next.

NNEC C2 Maturity levels

8. Figure 1 below shows a mapping of the NNEC C2 maturity levels to the maturity levels of NNEC. The horizontal arrow implies that the level of C2 is adequate to command all levels of NNEC maturity either at or below the tip of the arrowhead.

9. The remainder of this paper describes each of these NNEC C2 maturity levels in more detail,² as well as the key requirements for transitioning from one maturity level to the next.

David S. Alberts and Richard E. Hayes, *Understanding Command and Control* (Washington: CCRP, 2006), 75.

² We have excluded the Agile Enterprise level because our focus here is the operational employment of the force.

NNEC C2 Maturity → NNEC Maturity

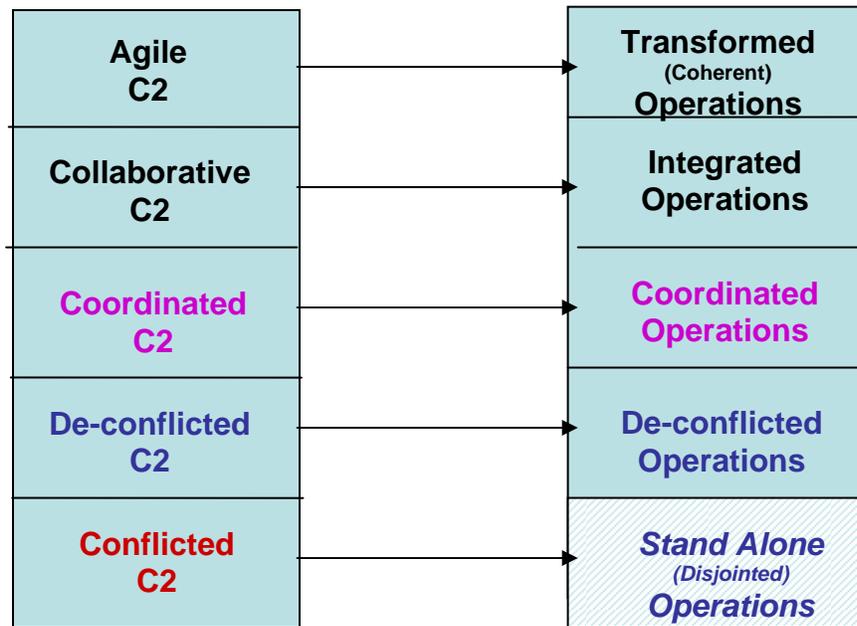


Figure 1: The relation between NNEC C2 Maturity and NEC Maturity.

C2 Maturity Levels

10. FIVE MATURITY LEVELS: The five C2 maturity levels depicted in Figure 1, from least capable to most capable, are: Conflicted, De-conflicted, Coordinated, Collaborative, and Agile. These C2 maturity levels are fractal, in that they can be applied to groups of individuals and organizations of any size. In the discussion below we are applying these concepts to the coalition as a whole; not to the manner in which contributing entities approach C2 but how the *collective* approaches C2.

11. SITUATION CONSIDERED: The situation is one in which there are two or more force elements (entities) present and where one or more of the following conditions exists: the entities have overlapping intents; the entities are operating in the same area at the same time; and the actions taken by an entity can come into conflict with those taken by another entities.

12. SITUATION AND RESPONSE DYNAMICS: The temporal dynamics of the situation and the timeliness requirements associated with a response can vary widely. Clearly the appropriateness of a particular approach to C2 as well as the selection of an option involves a consideration of responsiveness. In the discussions that follow, it is assumed that the frequency of information sharing, the frequency of interactions, and, in selected C2 approaches, the ability to change decision rights all match mission requirements.

13. WILLINGNESS: Information sharing and other forms of working together require willingness on the part of the involved entities. Such willingness is assumed in the discussions that follow. As a practical matter, it is possible that entities will agree to operate at a certain level of maturity but have either limited or no willingness to do what is necessary to make the selected approach to C2 work. For the purposes of this discussion, we consider this to be a failure to implement.

14. C2 OBJECTIVES BY MATURITY LEVEL: Given the situation described above, the objective of each of these approaches to the Command and Control of the civil-military coalition differs significantly. Note that each entity is expected to have its own approach to C2, one that may or may not be compatible with the approach adopted by (or defaulted into by) the coalition. The objectives associated with each of the five C2 maturity levels are as follows:

- a. Conflicted C2: None. The only C2 that exists is that exercised by the individual contributors over their own forces or organisations.
- b. De-conflicted C2: The avoidance of adverse cross-impacts between and among the participants by partitioning the problem space.
- c. Coordinated C2: To increase overall effectiveness by (1) seeking mutual support for intent, (2) developing relationships and links between and among entity plans and actions to reinforce or enhance effects, (3) some initial pooling of non-organic resources, and (4) increased sharing in the information domain to increase the quality of information.
- d. Collaborative C2: To develop significant synergies by (1) negotiating and establishing shared intent and a shared plan, (2) establishing or reconfiguring

roles, (3) coupling actions, (4) rich sharing of non-organic resources,³ (5) some pooling of organic⁴ resources, and (6) increasing interactions in the cognitive domain to increase shared awareness.

e. Agile C2: To provide the enterprise with additional C2 approach options that involve entities working more closely together and with the ability to identify and implement the most appropriate approach to coalition C2 given the situation (e.g., mission, conditions, and set of coalition partners/contributing entities).

15. C2 MATURITY LEVELS AND THE C2 APPROACH SPACE: As was stated earlier, approaches to C2 with different levels of maturity occupy different regions of the C2 approach space. The inter-related dimensions of this C2 approach space include: the distribution of information, the distribution of decision rights, and the patterns of interaction among the entities (individuals and organizations, which can be nested). The C2 maturity levels and their relationship to the C2 approach space are discussed below. Figure 2 provides a graphical representation of the mappings involved.

a. Conflicted C2: Given that the only C2 present at this maturity level is the organic C2 that exists within each of the entities, it is assumed that this C2 maturity level corresponds to the origin of the “cube”; that is, there is no distribution of information between or among the entities, that all decision rights remain within each of the entities, and that there are no interactions (in a C2 sense) between or among the entities.

b. De-conflicted C2: In order for entities to de-conflict their intents, plans, or actions they need to be able to recognize potential conflicts and attempt to resolve them by partitioning as a function of, for example, geography, function, and/or time. This involves limited information sharing and limited interactions. It does not require any changes in decision rights; although once a decision has been made to de-conflict it becomes a constraint on the entities. Thus a decision to de-conflict is not a distribution of decision rights but the making of a decision by a previously authorized entity. Given the limited nature of the information exchange and the interactions required, a de-conflicted C2 approach occupies a small two dimension region (locus of points) near the origin of the C2 approach space.

c. Coordinated C2: Coordination involves more than an agreement to modify one’s intent, plans, and actions to avoid potential conflicts. It involves the development of a degree of shared intent and an agreement to link actions in the various plans being developed by the individual contributors (elements or entities). This in turn requires a significant amount of information sharing (broader dissemination) and a richer set of interactions, both formal and informal (relative to those required for de-confliction) among those in the various elements that are involved in establishing intent and developing plans. While the interactions required may be quite frequent, they do not approach a continuous

³ *Non-organic resources* are resources not “owned” by participants. These include access to bridges and roads, and sharing of higher level ISTAR and logistics.

⁴ *Organic resources* are those “owned” by a participant. They may include vehicles, weapons, and local supplies.

interaction. While operating at this level of maturity does not require any changes in the distribution of decision rights, it does require that decisions regarding entity intents and plans be constrained by shared intent and linked plans. Thus the C2 approach space that corresponds to this level of C2 maturity occupies a 3-dimensional space that extends considerably along the information dissemination and interactions dimensions and a small distance along the distribution of decision rights dimension.

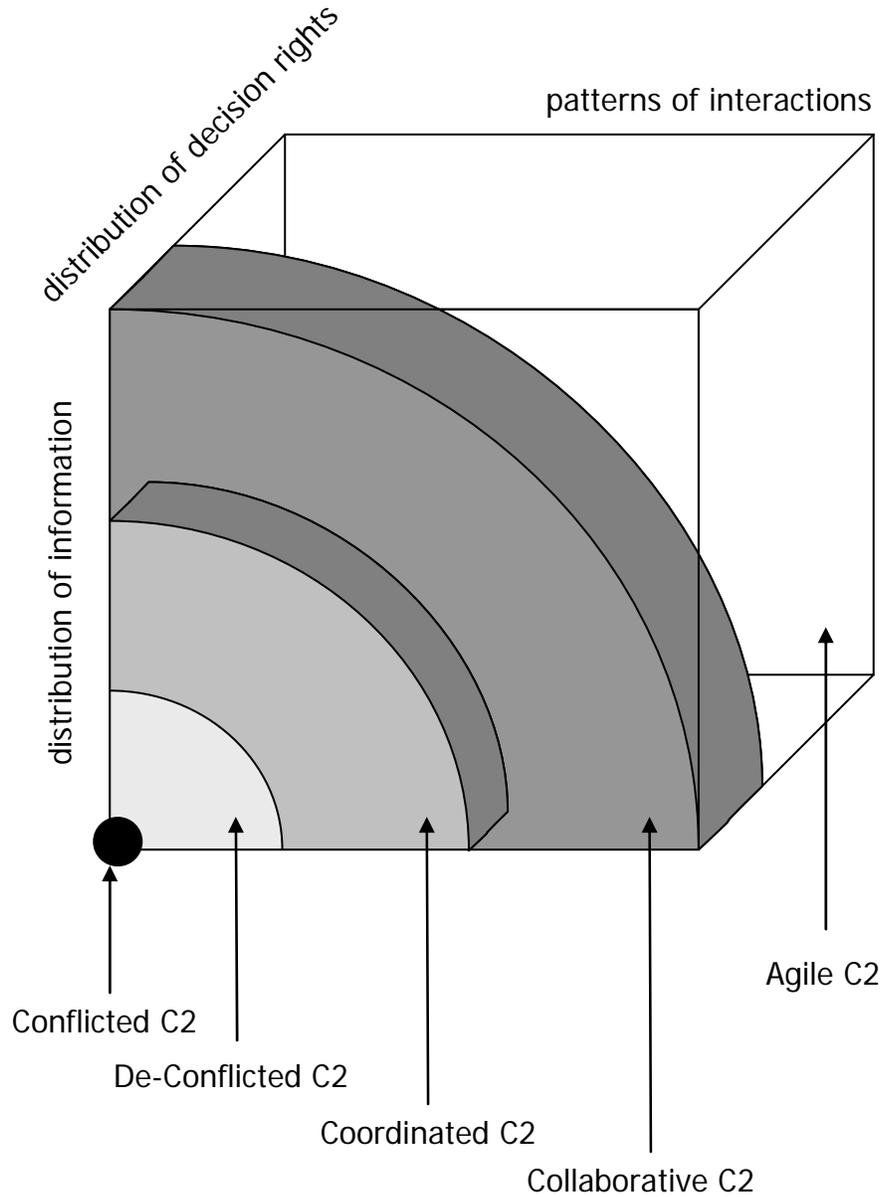


Figure 2: The levels of C2 maturity mapped to the C2 approach space.

d. Collaborative C2: This maturity level involves more than “a degree” of shared intent; it involves the collaborative development of a single shared plan. The intents of the entities/elements are subordinated to shared intent unless they do not

conflict with or detract from shared intent. Similarly, entity plans need to be supportive of the single integrated plan. Entities operating at this level of C2 maturity accept symbiotic relationships and are interdependent. Very frequent interactions, indeed approaching continuous interaction between/among identified individuals/organizations, involving richer and more extensive interchange in both the Information and Cognitive domains, is required to establish shared understanding and the development of a single plan. Thus, this maturity level corresponds to an area in the C2 approach space that extends across almost the full range of information dissemination and interaction dimensions and along a great deal of the decision rights dimension. Once shared intent has been established and an integrated plan has been developed, entities are “delegated” the rights to develop supporting plans and to dynamically adjust these plans collaboratively. The real delegation that takes place here occurs with the selection of this approach to C2 and the delegation by the entities to the collective for shared intent and a single integrated plan.

e. Agile C2: This level of C2 maturity distinguishes itself from the previous level with the addition of the option to self-synchronize as well as the ability to recognize which approach to C2 is appropriate for the situation and adopt that approach in a dynamic manner. The ability to self-synchronize requires that there exist a rich, shared understanding across the contributing elements. This in turn requires a robustly networked collection of entities with widespread and easy access to information, extensive sharing of information, rich and continuous interactions, and the broadest distribution of decision rights. In terms of the C2 approach space, Agile C2 allows the collection of entities to operate in the largest volume of C2 options, including reaching into the corner farthest from the origin, a space associated with Edge organizations.

16. DISCUSSION OF C2 MATURITY LEVELS: For each C2 maturity level, we have (1) identified the objective, (2) specified what the C2 function was seeking to achieve, and (3) located it in a region of the C2 approach space. This section is devoted to a discussion of some of the implications for the collective and for the contributing entities associated with operating at these different levels of C2 maturity.

a. Conflicted C2: It should be kept in mind that no C2 is being exercised at the endeavor or collective level. Each entity is pursuing its individual intent and taking independent action. Entities are operating in the area of operations without communicating with, sharing information with, or engaging in any C2-related interaction with each other. This means that there is no way to avoid some “negative cross-impact” between or among the participating entities. Thus, some actions will, in all likelihood, lead to adverse interactions, actions that interfere negatively with others. In other words, some of the actions of the independent entities are in conflict and increase costs, degrade effectiveness, or both. At times the actions of one entity may preclude an intended action of another entity. The net result is that the option space for mission accomplishment is less than the sum of the option spaces of the individual entities. The actual sum is less than the sum of its parts, and to the degree it is less there is an opportunity cost. There may be some situations where the probability of adverse impacts is low, the consequences

few, and the costs of moving to a higher C2 maturity level is high, or it is not possible (e.g., due to politics or time) to make the move to a more mature level of C2, where this (non)approach to C2 may be suitable. For example, in the very early stages of disaster relief (e.g., post-Tsunami) this may be appropriate. But it has been shown that to succeed in these types of situations, the maturity of the collective or endeavor C2 needs to evolve over time to a higher maturity level.

b. De-Conflicted C2: Entities that wish to de-conflict must be willing, at a minimum, to accept a constraint on their plans or actions. In return, they hope to avoid or remove any adverse cross-impacts. Limited peer-to-peer interaction in the Information domain must be sufficient to dynamically resolve potential cross-impacts. Total effectiveness in situations where a de-conflicted approach to C2 is taken can approach “the sum of the parts” in the limit. The main emphasis of C2 interactions and information flows is still on vertical interaction along “stove-piped” chains of command within each entity. A de-conflicted approach to C2 allows partners of different C2 levels of maturity to work together, co-existing in the same operational space. The nature of the constraints imposed will vary, but may include the creation of boundaries (exclusive areas assigned to a given entity) along time, space, function, and/or echelon lines. This serves to constrain each entity’s option space. Planning is required to establish the initial conditions (the decompositions or boundaries). This may be a lengthy process. Should these boundaries need to be changed, re-planning is generally cumbersome and slow. The boundaries become fault lines and are themselves targets or vulnerabilities to be protected. This approach to C2 is most appropriate when the situation and the response are stable and decomposable in terms of objectives, space, time, and function (no cross-impacts). Hence the situations that can be effectively handled by de-confliction are complicated, but not complex.

c. Coordinated C2: The previous C2 maturity level (de-conflicted C2) does not require any linking of plans or actions. Coordinated C2 involves seeking opportunities to generate synergy by linking the plans and actions of one entity with those of another. In this manner, actions may reinforce each other in the action or effects spaces or they may, in effect, combine resources to achieve a necessary threshold for effective action or significant effects. Total effectiveness is more than the sum of the effectiveness of individual actions. The option space expands for participating entities. However, planning time may increase as a function of the number and nature of the links between and among plans. This level of maturity begins to make it possible to form “task-organized” forces with contributions from different entities to simplify interactions across the air, land, and maritime domains, and other non-military actors. This level of maturity is appropriate for decomposable problems in terms of objectives, space, time, and function (with limited cross-impacts).

d. Collaborative C2: This level of maturity involves sharing of resources in addition to a requirement for more information sharing and interactions between and among the entities. It envisions going beyond specific and explicit links between and among plans to the collaborative development of a shared single plan that establishes symbiotic relationships. Total effectiveness is significantly more

than the sum of the effectiveness of individual actions due to the synergies that are created. The option space is significantly expanded. Entities plan in parallel, basing their individual plans on the shared plan. Because of this, planning times can be reduced. Collaborative C2 may involve the use of “positive control”⁵ to allow richer peer-to-peer interworking. To a far greater extent than is present in lower levels of C2 maturity, entities become interdependent. This is made possible as a result of the trust that is developed as a product of developing the necessary shared understanding required to create the single plan. As a consequence, risk is pooled (like insurance). This level allows the full implementation of “task-organized” forces across the coalition. This C2 approach is appropriate for problems that are not fully decomposable in terms of objectives, space, time, and function and thus for which a holistic approach is desirable.

e. Agile C2: Reaching this level of C2 maturity is predicated upon achieving a high degree of shared understanding of a common (collective) intent. It requires a rich and continuous set of interactions between/among participants, involving widespread information exchanges to allow the build-up of shared understanding, and the ability (where appropriate) to self-synchronize. The increased effectiveness that can be achieved can be accompanied by a potential reduction in the total resources required. Furthermore, as its name implies, the level of C2 maturity is inherently agile, making it required for situations characterized by high dynamics, uncertainty, and complexity.

17. TRANSITION REQUIREMENTS: The ability to achieve a given level of C2 maturity, to move from any given level to the next higher level, requires the addition of one or more key capabilities that in turn require improvement in the “info-structure” and changes in C2 concepts and processes. This section identifies some of these transition requirements.

a. From Conflicted to Deconflicted: The following C2-related tasks must be accomplished: identification of potential conflicts and resolution of conflicts by establishing constraints and/or boundaries. In order to accomplish this, limited communications involving limited individuals and limited information exchanges are required.

b. From Deconflicted to Coordinated: The following C2-related tasks must be accomplished: development of limited shared intent and development of links between and among individual plans and actions. In order to accomplish this, a coordination process needs to be established supported by sufficient communications, and information-related capabilities involving appropriate individuals and necessary information exchanges are required.

c. From Coordinated to Collaborated: The following C2-related tasks must be accomplished: development of shared intent, shared understanding and trust, development of a single integrated plan, and parallel development of entities’ plans that are synchronized with the overall plan. In order to accomplish this, a set

⁵ Positive control allows the superior commander (military or civilian) to be informed of such interchange and to intervene only when he/she can see that such an interchange would not match with higher level, more strategic requirements.

of collaborative processes needs to be established supported by a sufficiently robust and extensively distributed collaborative environment available to all appropriate individuals and organizations.

d. From Collaborative to Agile: The following C2-related tasks must be accomplished: development of shared intent, awareness, and understanding. In order to accomplish this, power to the edge principles and associated doctrine must be adopted, supported by a robust, secure, ubiquitous, interoperable infrastructure that extends to all participating entities.

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References

[1] Atkinson, Simon, and James Moffat. 2005. *The Agile Organization*. Washington: CCRP.

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[3] Alberts, David S., and James Moffat. 2006. "Maturity Levels for NATO NEC Command." UK: Defence Science & Technology Laboratory.

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