CD&E METHODOLOGY
CCDC-01

Version 2.0
January 2022
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FOREWORD

The drafting of the first version of this manual was the fruit of several years of work in the early days of the Concept Development Joint Center (CCDC). When the Center was created in 2016, as the heir to the Transformation Unit of the Armed Forces, one of the first tasks undertaken was to draft an instruction setting out the rules on the joint concept development process.

The development of joint concepts is regulated by CHOD Communicated Instruction 10/21. It states that the CCDC is responsible for “setting out the most appropriate methodology to resolve the problems that may arise, as well as for editing and keeping updated the necessary documentation for its correct application.”

After developing several concepts applying, mainly, the NATO CD&E doctrine, the CCDC started to elaborate its own national methodology, adapted to the particularities of our organization and our processes. The result of this process was the publication, in May 2019, of the first version of the CD&E Methodology CCDC-01.

Over the past two years, the manual has been used as a guide to develop new joint conceptual documents and for the training of the Center’s analysts. Bearing in mind the lessons learned in each of the projects conducted, and the comments and suggestions of its users, the document was revised with the aim of making it clearer, giving it a more practical approach, a more current format and, in short, reflecting all the experience accumulated by the Center during this time.

The result of this review is intended to be an attractive and easy-to-read document that will be useful both for those who, approaching this subject for the first time, wish to know the theoretical foundations of the CD&E methodology; as well as for project managers and analysts looking for a practical guide to each phase of the concept development process.

This manual is focused on joint conceptual development, but it is considered of interest to the entire national CD&E community and is therefore made available to you as a useful tool for solving operational problems faced by our Armed Forces.

Madrid, January 24, 2022
The Head of the Concept Development Joint Center

///ORIGINAL SIGNED///

- Major General José Antonio Herrera Llamas -
INTRODUCTION

1. BACKGROUND

01. The Organic Law 05/2005 on National Defence stipulates that the Chief of Defence Staff (CHOD) is responsible for setting out the rules for the joint action of the Armed Forces and for contributing to defining the rules for combined action of multinational forces.

02. Order DEF/710/2020 implements the basic organization of the Defence Staff (EMAD). This order establishes the Force Development Division (DIVDEF) within the Joint Staff (EMACON), which shall assume responsibility for the cross-cutting Force Development process.

03. The CCDC is integrated into the DIVDEF which, according to the aforementioned order, is responsible for promoting and directing the development of new concepts.

04. CHOD Instruction 55/21 implements the organization of the Defence Staff and the tasks of its subordinate bodies, by establishing relationships between the DIVDEF and several of these bodies concerning developing and implementing joint operational concepts. This instruction provides that the CCDC shall have a Concept Development and Experimentation Section.

05. CHOD Communicated Instruction 10/21 sets out the rules on the process of developing operational concepts to guide the later development of military capabilities, and regulates the participation of the relevant bodies of the Defence Staff and the Army, the Navy and the Air Force in this process.

06. The same Communicated Instruction 10/21 of the CHOD makes the CCDC responsible for setting out the most appropriate methodology for resolving the problems that may arise, as well as for editing and keeping updated the necessary documentation for its proper application.

2. PURPOSE

07. To establish the methodology to be used in the development of joint military concepts that will provide rigorous solutions to the operational military problems that might be detected\(^1\), for subsequent implementation.

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\(^1\) Although the methodology refers to the joint domain, it is applicable to any domain.
PART I - GENERAL ASPECTS
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CHAPTER 1. OPERATIONAL MILITARY PROBLEM AND CONCEPT

1. CD&E METHODOLOGY

08. The Concept Development & Experimentation (CD&E) process is the succession of activities focused on identifying, preparing, refining and validating solutions to problems that, by applying creative thinking and an analytical methodology, describe how a Force shall use new or existing capabilities (DOTMLPF-I) to operate in a given, existing or planned environment.

2. OPERATIONAL MILITARY PROBLEM

09. An Operational Military Problem (OMP) is a shortfall or lack of capability of the Joint Force to perform its functions in a given operational environment.

10. An OMP statement should be concise and brief, and written using simple and plain language, using approved doctrinal terms whenever possible. Two key elements should be distinguished in the statement:
   - The situation that led to the problem detection, either from the analysis of the strategic environment or its implications at the operational level, or whether it was the result of an operation, an exercise, an activity, etc.
   - The lack or shortfall of a capability concerning that situation and the task assigned to the organization. An OMP can be classified as a Basic Problem (BP), when, after a first analysis, it is determined that there are already means with which to shape a solution by reorganizing and reviewing the elements of the capability, without the need to develop a new capability.

3. CONCEPT

11. A concept is, in general, an idea that solves a problem. In the military context, a concept is the solution to an OMP and it is intended to guide the development or the update (in the case of basic problems) of the capability being studied.

12. The following sections present the different types of concept papers. Besides their definitions and fundamental characteristics, their hierarchy is established and which ones of them are the subject of this manual.

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3 PDC-00 Glossary of Terminology for the Joint environment.
4 CHOD Communicated Instruction 10/21.
5 Defined by the elements that compose it (DOTMLPF-I).
3.1. CONCEPT NOTES

13. They are *foresight discussion papers which are not as important as a concept*, that investigate issues of interest for a later conceptual development. This opportunity will usually come from changes in the operational environment, the possibility of improving capabilities with new technologies, organizational changes, new procedures, or other causes. ²⁶

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³ Concept Note Multi-Domain Operations - April 2020

3.2. EXPLORATORY CONCEPT

14. Conceptual document that *assesses the challenges* that will foreseeably arise in *future scenarios* and the characteristics that the Joint Force should have to face them. ²⁶

15. They are used to guide thinking in long-term planning; hence it is important that they are widely disseminated. Usually, they are not followed by an Implementation Plan. They might become outdated, so they should be reviewed at the end of each medium-term planning cycle.

16. The development of these concepts relies mainly on discovery events, where the participation of accredited experts is the main guarantee of quality. They will rarely be validated in a hypothesis-testing experiment.

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⁴ Exploratory Concept Cognitive Domain - May 2020

3.3. BASIC JOINT CONCEPT

17. A document that sets out the framework, principles and rationale for *solving a basic problem* (BP), by reorganizing and revising the means of one or more existing capabilities.

18. Once published, it shall be implemented either through an Implementation Plan or through specific directives according to the recommendations provided in the concept. ²⁶

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⁵ JISR National Concept - July 2017

⁶ Personnel Recovery Basic Concept - December 2020

⁷ Joint Electromagnetic Operations (EMO) Basic Concept - December 2021

3.4. OPERATIONAL JOINT CONCEPT

19. An Operational Concept is a *solution to an OMP*, current or future, that describes how the Joint Force will employ certain capabilities to operate in an operational environment.

20. The concept, based on the framework for employment of the Joint Force, the operational environment and the problem that may arises in that environment, presents the theoretical solution to that problem and the recommendations to implement them, referring to each DOTMLPF-I element of the capability in question. These recommendations should serve as a guide for the later Implementation Plan.

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²⁶ CHOD Communicated Instruction 10/21.
21. Since it addresses a new solution, its development requires the use of an analytical methodology (CD&E type) that will guarantee its validity in terms of suitability, acceptability and practicability.

22. Moreover, the solution must be validated by experimentation and provide sufficient practicable recommendations to make its implementation possible.

3.5. CONCEPT OF EMPLOYMENT OF THE ARMED FORCES (CEFAS)

23. It is the document in which the CHOD develops the Military Strategy, guides the planning cycle and provides the basis for redefining the Joint Force.

24. It is not the subject of this manual.

25. Figure 1 represents the hierarchy of the different conceptual documents according to their level of complexity.

26. Besides those mentioned above, there are a number of documents called “concepts” that do not fit in the definition proposed in this manual. These include Concepts of Operations (CONOPS) or Concepts of employment for some weapon systems. On the other hand, Directives, although they might guide conceptual developments, they shall not to be considered concepts.

4. PRINCIPLES OF CONCEPTUAL DEVELOPMENT

27. The development of conceptual documents must be governed by a series of principles that guarantee their validity, viability and applicability:

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7 CHOD Communicated Instruction 10/21.
8 As included in Appendix B of the CHOD Communicated Instruction 10/21 for Developing Joint Concepts.
Effectiveness. The proposed solution must fully solve the problem, be appropriate, practicable and acceptable, enhance military capabilities and fill the identified gap or shortfall. Consensus is a variable that will not be considered into the concept development process; it is always a desirable result of the discussion process of phase 2), but it is never an end in itself, nor an objective to be achieved. 

Creativity and freedom of thought. Creativity shall be encouraged, eliminating or at least minimizing as far as possible potentially limiting factors, such as institutional positions, customs and habits, current regulations, impediments derived from the positions or interests of the parties involved, and attitudes such as reluctance to change. Thus, during the creative phase of the process (the discovery and development phase), the aim is to promote open discussion based on arguments and ideas, with a vision into the future, a vision of change and transformation.

Rigor. The strict application of the methodology and guiding principles in analyzing and dealing with the problems, in the argumentation and data capture and in the search for solutions.

Innovation. A driving element in the transformation of the Armed Forces, understood as the capability to adopt and adapt new possibilities (technological, organizational, etc.) to the shape the capabilities of the Joint Force, with the idea of improving its effectiveness and solving the operational problems that may arise. It is the backbone of the concept development process. Innovation means change; it means improving what already exists by introducing something new. To innovate means breaking down barriers and overcoming what is established to improve it. So that the current capabilities and ways of doing things should never be an impediment for the innovation and improvement of those existing capabilities.

Participation of those who can provide added value to the project. Subject Matter Experts (SME) from the organization with knowledge of the subject shall be involved. Those SME will discuss and contribute with their ideas to the debate. Likewise, SME from other State administrations or from the civil world shall be invited to participate, if considered necessary. In any case, the possibility of participation of the Academic environment and Industry in the different phases of the project should always be considered.

Collaboration. Under the direction of the Project Manager, the work shall be developed in a collaborative way among all participating SME, working effectively, using constructive criticism and respectful disagreement, and supporting the work of the other participants to achieve the common goal, which is to solve the OMP.

Transparency. All work shall be developed with maximum transparency, sharing with all parties the ideas and arguments of the discussion, as well as the development of the work, emphasizing clarity and avoiding ambiguities at all times.

Solution's space. The scope of the solution shall normally be limited to the competences of the CHOD, although on occasions, the proposed solution shall require extending it beyond the Defence Staff, affecting other authorities and organizations.
In this case, the proposed solution shall be maintained, signifying this circumstance. Strictly limiting the solution to the scope of the Defence Staff could result in the proposal not being as complete and appropriate as it should be.

28. Besides the foregoing principles, the idea of “failing,” “erring,” or “rejecting” plays an important role in the CD&E process. If the risk of failure were not taken, only safe projects based on ideas to continue as until now would be initiated. Innovative ideas, however promising or transformative, would be put aside, and discovery experiments would be considered a waste of time. In this context failure is not only possible but desirable. Not all concepts (or parts thereof) shall succeed, not all ideas have to work, operational shortfalls change, technologies become obsolete, experimentation may prove a concept or transformational idea to be invalid, a concept may work in theory but not in practice....

29. The management of a CD&E project shall include a process of generating and collecting innovative ideas as possible solutions to the military problem under study. Not all of them shall be valid, so identifying a failed idea or a wrong course of action as soon as possible shall save resources and efforts. Failing fast for the right reasons is essential for proper concept development.

5. **STRUCTURE AND CONTENT OF A CONCEPT**

30. This section describes how to structure the development of a concept, starting from the different aspects to be addressed to give it content, and considering the resources and measures necessary to undertake the resolution of the proposed OMP.

31. To this end, a model has been designed to facilitate the structuring of the different actions to be taken.
5.1. CONCEPT MODEL

Figure 2 - Concept model

32. The following elements are identified in the above model:
   - **Operational Military Problem**: shortfall or lack of capability of the Joint Force to perform its functions in a given operational environment.
   - **Situation**: context in which a task is assigned to the force.
   - **Mission**: duty entrusted to an organization to achieve its goals.
   - **Military shortfall**: lack of force capability to undertake a task.
   - **Principles**: basic rules or ideas that direct the thinking and the ways in the development of a solution.
   - **Assumption**: acceptance of a belief as valid through the evidence one possesses.
   - **Solution**: central idea that solves in a general way the military problem posed.
   - **Organization**: a group of people, regulated by a set of rules, that pursues the achievement of certain goals; in this case, the execution of the task.
   - **Tasks**: set of actions to be developed by the organization to achieve an objective.
   - **Resources**: set of material elements, infrastructure, information, doctrine, education or training necessary to implement the solution.
   - **Guidelines**: general instructions or rules that guide the implementation of the solution.

33. The **situation**, **mission** and **military shortfall** are combined to produce the **OMP** statement.

34. The **principles** should underpin the development of the solution. They should be used as a reference to guide the type of actions to be taken to solve the problem.

35. The **assumptions** limit the scope of application of the solution, since the solution shall not be valid if the assumptions are not met.

36. The **solution** is composed of a series of actions or **tasks** necessary to solve each shortfall. These tasks can be translated into processes to facilitate the recognition of the stakeholders involved, in the form of organizations or units, the relationships that shall exist between them and the necessary exchanges of information. This makes it possible to define the
organization that shall be in charge of executing the solution, and from there, it is also possible to define the necessary **resources**.

37. To implement the solution, it shall be necessary to include a set of **guidelines** that determine the conditions under which the solution shall be applied, limit its scope and harmonize with other solutions in the **organization**.

### 5.2. STRUCTURE OF THE CONCEPT DOCUMENT

38. The concept paper should consist of at least the following elements:

- **Introduction and background**: includes the statement of the OMP and references to the directive of the authority ordering its development (in the joint scope, the CHOD), as well as a brief description of the concept, its **objectives** and expected **scope**. The **methodology** used is also described in this section.
- **Problem analysis**: contains a description of the **operational environment** and its **implications** for the Armed Forces, the **current status** of the problem and the **deficiencies** identified.
- **Central idea**: central idea on which to build the solution to the problem posed. This section includes the hypothesis (or hypotheses) that the concept raised and that shall be validated.
- **Recommendations**: recommendations, based on the proposed solution, on each of the **DOTMLPF-I factors**, which shall serve to guide the Implementation Plan. This section also includes any other additional factor that complements those described in the DOTMLPF-I in the solution of the problem.
- **Conclusions**.
- **Future lines of action**: this section shall describe other activities that are considered to be of interest once the development of the concept has been completed.
- **Appendices**: bibliography, glossary of terms and acronyms, and any other addenda considered of interest for a better understanding of the document.

### 5.3. QUALITY STANDARDS IN CONCEPT WRITING

39. The concept should be **written in a simple way**, following a clear line of argument, so that it can be understood by non-specialists in the field.

40. The concept shall be written using **common terms accepted in the body of doctrine**, avoiding coining new terms as far as possible. If this is necessary, a glossary of terms shall be included with the definition of each one of them. Moreover, the use of vocabulary and terminology particular to specific fields should be avoided.

41. Whenever a term is named in the **glossary**, the **italic** font style shall be used to alert the reader that the term has a specific meaning within the concept.

42. The concept is usually written with a **predominance of subjunctives and conditionals** and avoiding, as far as possible, **imperatives**. It should not be forgotten that a concept is a guiding document of an innovative nature. It is **neither an instruction nor a prescriptive document** from which regulations or actions are directly derived.
43. The use of historical examples can be useful for the understanding of the ideas put forward, but they should always be presented in a clearly differentiated manner with respect to the main text.

44. The concepts, like all documents developed by CCDC, shall use common formatting and layout standards.

45. As a guideline, a concept should be about 20 pages long and should be read in one sitting without the need for any appendices. The appendices shall contain additional information that the reader can use to go deeper into the ideas presented.

6. HARMONIZATION OF CONCEPTS

46. Harmonization is intended to ensure that the concept under development does not conflict with other areas of conceptual or doctrinal development and that interoperability with other capabilities is maintained.

47. For this harmonization analysis to be feasible, it is desirable that all concepts have a similar structure so that they can be harmonized vertically, that is, to check that the concept under development follows the guidelines of the higher concepts; and horizontally, that is, to check that the concept under development does not overlap with other solutions already developed or, more importantly, that it does not contradict them.

6.1. VERTICAL HARMONIZATION

48. Sometimes, the concepts developed are high-level solutions that cannot be implemented directly, but rather are used to guide a number of subordinate concepts. This usually occurs because the tasks identified in the high-level concept cannot be executed directly, due to a lack of the necessary capabilities. This will create a new lower-level operational problem requiring a new conceptual solution.

49. Vertical harmonization is the verification of the consistency of a concept within its conceptual hierarchy. To this end, a verification must be made that the gaps emanate from tasks imposed by the higher concept, that the guidelines for the higher concept are used as principles in the new solution, that the assumptions made in the higher concept are still valid in the new solution, and that the new assumptions made in the concept are consistent with those already existing in the higher concept.

50. Figure 3 depicts the vertical harmonization within the conceptual development process.
6.2. HORIZONTAL HARMONIZATION

51. A higher-level concept may lead to more than one subordinate concept, each solving a part of the problem produced by the implementation of the higher-level concept.

52. In this case it is necessary to check their horizontal harmonization, that is, their compatibility and complementarity. To this end, a verification is made that both concepts use the same principles, or at least compatible and complementary principles, and that both use the same assumptions. Likewise, the organization, subordinate tasks, resources and guidelines proposed by each concept will be analyzed to verify their compatibility. Figure 4 shows how horizontal harmonization is articulated.
Figure 4 - Horizontal harmonization
7. THE DEVELOPMENT OF CONCEPTS IN THE FORCE DEVELOPMENT PROCESS

53. In this manual, **Force Development** shall be understood as the continuous process of equipping the members and units of the Joint Force with the competencies they require to operate cohesively and efficiently and to maintain these competencies over time.⁹

54. By **joint competencies**, we mean the set of knowledge, skills and mindset necessary for integrated operation as a single joint force. **Knowledge** is the theoretical resources individuals need to perform their functions. **Skill** is the dexterity, expertise and experience in using the material or cognitive resources made available to the individual or unit. And **mindset** is the way of structured thinking that leads to the interpretation of reality, decision-making and coherent action. Joint competencies are not achieved automatically and are perishable. They must be nurtured and preserved through continuous effort.

55. The necessary knowledge is identified through lessons learned, analysis of operations and foresight of the future operational scenarios. It is developed through concepts, doctrine and procedures. It is transmitted through training and instruction. Skills are enhanced through individual and collective training. Mindset is developed through education and training.

56. Concept development is divided into three main activities:

- **Detection and prioritization of capability gaps (Operational Military Problems).** This involves determining the existence of OMP derived from operational scenarios, lessons learned from ongoing operations or technological and conceptual opportunities. Given that the organization’s concept development capability is limited, once these OMP have been identified, they will be prioritized to select which ones will be addressed in the next cycle. The selected OMP shall be included in the Joint Concept Programme to be studied in the next development cycle.

- **Development and validation of solutions.** In this phase, OMP are analyzed to generate a solution that enhances military capabilities and fills the gap that has been identified in the problem. To ensure that this solution is appropriate, practicable and acceptable, it shall also undergo a validation process before being submitted for approval.

  The solution development process is structured in **projects.** A project is the name given to each of the lines of management and development activities, framed within specific dates, aimed at producing a specific solution to an OMP.

  As noted above, the set of projects undertaken in a cycle constitutes the **Joint Concept Programme (JCP).**

- **Implementation of solutions.** The concept is not a prescriptive document, but a descriptive and guiding one. For the solution to be transferred to the Joint Force, it is necessary to implement a concrete action plan that enhances certain aspects of its capabilities.

  In the concept, recommendations for the changes to the DOTMLPF-I elements of existing capabilities will be developed. These recommendations may involve both material and non-material solutions.

  These recommendations shall guide the development of an **Implementation Plan for the solution,** which shall contain the actions to be executed by each Defence Staff

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⁹ PDC-01 (A) Doctrine for Employing the Armed Forces (CHOD, February 2018).
agency, the timeframe for their execution and the criteria that will indicate that the Initial Operational Capability (IOC) and Final Operational Capability (FOC) have been achieved.

When material solutions involve the acquisition of equipment or the incorporation of new technology, the CD&E process should be able to support the definition of the material requirements needed to be transferred to the Force Planning Process.

Non-material solutions take the form of recommendations for changes in doctrine, organization, education or training. These types of solutions are often an essential part of force development, allowing new ideas and existing capabilities to be exploited in an ever-constraining economic environment, increasing efficiency.

8. EXPERIMENTATION AND OPERATIONS RESEARCH

57. The validity and rigor of a concept is given by the application of analytical and empirical methods during its development. The use of military experimentation and operational research will provide the ability to explore, test, refine and validate concepts iteratively.

58. A military experiment is a controlled research aimed at discovering new knowledge, accepting or rejecting a new hypothesis or validating a solution to a given problem or a part of it.

59. Operations research is defined as the application of the scientific method in the decision making process.

9. EXPERTS IN THE CONCEPT DEVELOPMENT PROCESS

60. A Subject Matter Expert is defined as a person who has in-depth knowledge or experience about the problem being analyzed. They are either professionals who face the problem in their daily work or they have recognized training, knowledge or experience to develop some aspect of the required solution.

61. The basic requirement for the selection of an expert is that he should have the knowledge and experience in the topic acquired through years of work (praxis), which might have been complemented by knowledge acquired through training, study or research.

62. Chapters 5 and 7 of this manual discuss the SME selection process in more depth.

10 CHOD Communicated Instruction 10/21.
CHAPTER 2. OMP DETECTION AND PRIORITIZATION

1 INTRODUCTION

63. As defined in Chapter 1, an OMP is a shortfall or lack of capability of the Joint Force to perform its functions in a given operational environment.

64. The detection of Operational Military Problems begins by identifying the need to enhance certain capabilities. This can be determined through three lines of analysis:
   - Analysis of changes in the strategic framework that may require new operational scenarios with implications for Joint Force operations.
   - Analysis of current operations and exercises, that highlights that there is a specific lack of capability to face a given operational scenario.
   - Analysis of the opportunities brought by new conceptual or technological advances showing a more efficient way for the Joint Force to operate.

65. If, as a result of these analyses, the need to enhance a capability is indeed identified, the OMP will be easily stated by linking the clauses of situation, implications and capability gap or need.

66. These initial problems should be validated before starting the development of a new solution. To this end, an initial analysis of existing and planned capabilities shall be conducted to check whether they can contribute to solve the identified problem and mitigate the risk.

67. If a solution to the problem can be developed with the existing capabilities, then it can be implemented immediately by developing of a Basic Concept. If a solution does not exist or is not mature enough then it will be necessary to develop a new concept that generates such a solution.

68. Before beginning this development, a preliminary analysis of the nature and complexity of the problem shall also be performed to determine the feasibility of addressing with the application of the CD&E methodology.

69. Once the problems have been identified, a comparative analysis of the risks and impacts on Joint Force operations, and the opportunity to resolve them, shall be performed, so that they can be prioritized for inclusion in the Joint Concepts Programme.

2 ACTIVITIES

2.1 OPERATIONAL SCENARIOS

70. Based on the conceptual and allied frameworks, the strategic level (CHOD) keeps the military strategy up to date and sets out the strategic framework for military planning, with its evolution guidelines, identifying risks and threats, as well as possible strategic implications and changes in trends.

71. Based on this strategic framework, possible operational scenarios are set out and included in the Concept of Employment of the Armed Forces. These scenarios are the possible situations of instability in which, foreseeably, the use of the Joint Force will be necessary as part of the solution.
72. The CCDC will periodically review the updates to the strategic framework and future operational environments for potential implications for the Joint Force.

2.2 IMPLICATIONS FOR THE JOINT FORCE

73. By Implications for the Joint Force, we mean the general characteristics that the Joint Force must have to operate successfully in the operational scenarios defined in the strategic framework.

74. These implications serve as a reference to develop specific recommendations for approaching long-term capability planning, adapting them to the possible evolution of the strategic framework.

75. Likewise, the CCDC studies Lessons Learned (LL) from ongoing operations and exercises in which the Joint Force is involved, looking for capability inadequacies to accomplish its missions in the current strategic environment. These inadequacies could be used to guide capability development in the short to medium term.

76. The Analysis and Foresight Section of the CCDC, in collaboration with the General Directorate for Armament and Material (DGAM) Technology Observatory, analyzes new disruptive technologies and trends in search for opportunities to enhance capabilities.

2.3 CAPABILITY GAPS

77. Given its privileged location at the strategic level, the Joint Staff has visibility into the Joint Force operational scenarios and the lessons learned, thus it is able to determine if there are capability gaps or opportunities for improvement, which are not covered by current or future Force Plans.

78. The existence of a capability gap or shortfall can be deduced from this analysis. This will lead to an Operational Military Problem Proposal (OMPP), which shall reflect the real or foreseen operational situation, its implications and the gap detected to face the mentioned scenario.

79. OMPs are not always obvious, and their detection and statement is not always an easy task. In any case, an OMP must be supported by documentation. The initial analysis of the OMP should make it possible to extract the metrics of the problem that make its existence evident, and its possible implications for the Armed Forces, which will determine its relevance. After this analysis, a better understanding of the problem will be gained and the OMPP can be drafted.

2.4 OPERATIONAL MILITARY PROBLEM PROPOSAL

80. Following the analysis of implications for the Joint Force, and if a gap or opportunity is identified, a specific OMPP is developed for which there is no suitable military approach, or for which a better approach could be envisaged as a solution.

81. The detection of a deficiency or shortfall in an operational capability may originate in any area of the Ministry of Defence, which should submit it to JEMACON in the form of an OMPP for study and validation.

82. Each OMPP must undergo an initial problem validation process to verify the diagnosed existence of a present or future problem, or that an opportunity to operate more effectively
has been detected. To conduct this validation it is necessary to answer the following questions from the point of view of military capabilities, with the aim of identifying whether the problem actually exists and is well diagnosed:

1. What is the operational environment and where within the strategic framework does it come from?
2. What change in the environment has created the problem?
3. In what area and in what capability does the problem fall?
4. Is it a new capability what is needed to solve the problem?
5. If the capability already exist, what gaps should be addressed to solve the problem?
6. What are the risks taken if the problem is not solved?

83. Capability analysis is the study of the problem from the point of view of the possible solutions. Once the OMPP has been formulated, the stated capability gap must be analyzed to see, in light of existing, developing or planned capabilities, if there is already a solution that could be implemented more quickly or if it is under development. And, If there is no solution, if it should be developed through the CD&E process. The following three simple questions aim at finding out what is already available or what is being done in the Armed Forces to solve the problem:

7. What developments are ongoing in that specific capability area?
8. Why can’t the problem be solved using existing or planned capabilities?
9. What use can be made of existing developments or capabilities to address the gap?

2.5 CAPABILITY ANALYSIS

84. The result of this analysis can yield five outcomes:

- **The solution exists, there is no shortfall of capability**, there are means and structures, but the problem is not being addressed properly. The problem needs to be analyzed and the solution organized. Typically, the solution will be described by an instruction from the appropriate command.

- **The solution exists, but there is no doctrine to take advantage of it.** A doctrinal development is necessary, which may culminate in a validation exercise of the new doctrine.

- **The solution exists, but in an immature state.** It may be necessary to develop a basic concept to reorganize some of the capabilities, or it may simply require a plan of action that would make the solutions available to the force.

- **There is a lack of guidance on the problem.** It is necessary to establish the basic definitions and concepts of the problem through a concept note.

- **There is a lack of knowledge about the problem.** It is necessary to develop an exploratory concept that expands knowledge about the problem.

- **The solution does not exist.** A concept needs to be developed to guide the development of a new capability. The concept should be tested and validated through experimentation before moving into the capability implementation phase. The solution
could probably be implemented through the short to medium term force development plans.

- **The solution does not exist and requires a transformation** in the way we operate. Rigorous research is needed to determine what the new operational requirements and new technologies will be needed. A new concept will be developed and should be experimented for refinement and validation. Once promulgated, the concept will guide the development of the capabilities in the long-term force development plans.

85. Not every OMP shall result in a concept development. The need for concept development is not necessary on every occasion; it shall depend upon the outcome of the capabilities analysis, whether an existing or programmed solution has been identified, and how mature the solution to be implemented is.

86. After this analysis, it shall be possible to determine which problems need to be transferred to the CD&E process to develop an operational concept and which can be solved quickly by means of instructions, doctrine or a basic concept, which does not require experimentation.

![Figure 5 - Result of the capabilities analysis](image)

**2.6 FEASIBILITY OF APPLYING THE CD&E METHODOLOGY TO A OMPP**

87. Attempts have sometimes been made to use the CD&E methodology to develop solutions to problems that require a new policy or strategy, research or plan, but not a new operational concept.

88. It is also possible that the level of abstraction of the problem-solution set does not allow for experimentation, generally because the problem is not an operational problem; or the problem may be located within a domain where military solutions cannot be developed (for example, when the problem is located within the legal framework).

89. Therefore, before transferring an OMPP to the JCP it is necessary to analyze it to ensure that it would be possible to solve it by applying the CD&E methodology. To do so, the following questions should be answered:
• **Initial Problem Check**: Is it an operational military problem at the operational level? What joint function does the problem fall under? Is the existence of the military problem documented by any indicators? Is there a “customer” who has identified the problem?

• **Initial check of the possible solution**: Can the problem be solved using already existing or planned capabilities? Is the solution to the problem a military capability? Will the level of abstraction of the solution allow experimentation? Is it possible to model the problem and the solution?

### 2.7 RISK ANALYSIS OF AN OMP

90. Once the OMP have been identified and validated, they will undergo a risk analysis to determine the urgency and the impact on current operations. This assessment will allow to prioritize them for resolution.

91. To determine the **urgency**, the origin of the OMP shall be analyzed, whether it is based on a future operational environment, or derived from a lesson learned from current operations. Problems arising from current operations shall have a greater urgency.

92. To determine the **impact**, the **frequency** with which the problem occurs within the expected scope of operations and the potential **consequences** of not implementing the potential solution shall be analyzed.

### 2.8 OMP PRIORITIZATION

93. Once the OMP have been analyzed, they shall be assigned an evaluation based on their urgency and expected impact. Moreover, the opportunity to undertake the solution of each of the identified problems shall be assessed, depending upon the available technology, the associated costs and the support needed in the development.

94. In view of this assessment, a prioritized proposal is drawn up for all the problems received and analyzed, according to the criteria set forth and those set out by the strategic level, so that their solution can be undertaken sequentially, according to the resources available.

### 3 DELIVERABLES

#### 3.1 PRESENTATION OMP: PROPOSAL AND STATEMENT

95. Those OMPPs assessed and validated by the CCDC are considered OMP. Their statement is the final product of this process.

96. The military problem **statement** should be written in simple and clear language, using approved doctrinal terms whenever possible. It usually has two parts: a first part describing the situation drawn from the analysis of the strategic environment or its implications at the operational level, and a second part explaining the shortfall concerning that situation.
97. Besides the statement, the presentation of the OMP shall include a summary of the analysis conducted; the justification of how this problem affects the Armed Forces; a list of initiatives, working groups or documents concerning the problem and, finally, a preliminary proposal of actions to be taken.

3.2 JOINT CONCEPTS PROGRAMME

98. The Joint Concepts Programme (JCP) is the document that details the CHOD’s joint concept development needs and priorities, as well as the actions and activities required to facilitate and optimize their execution.

Example: problem statement of the National CUAS-LSS Concept

"Faced with the reckless or hostile use of LSS UAS, operating outside of comprehensive air defence capabilities, the units of our Armed Forces deployed in operations, and in military installations, inside and outside national territory, do not have a comprehensive capability that allows them to prevent, detect, identify, decide and, if necessary, neutralize them."

99. For each of the OMPs that it is decided to undertake, the CHOD shall issue a Concept Development Directive (CDD) in which it will provide guidelines to develop the concept, orient the development of the solution and establish the necessary support structures.

100. This should include the following aspects:

- **Background**: documentation and arguments that have led to the identification of the problem.
- **OMP statement**: as described in this chapter.
- **CHOD vision**: this is a simple conceptual paragraph giving a guideline on how to approach the problem and the end state that is foreseen once the problem has been solved.
- **Solution space**: the framework that limits the level of ambition of the solution. Generally, the solution space of an operational concept shall be the competencies of the CHOD, but the directive may expand this space if the preliminary analysis of the problem anticipates that more in-depth changes shall be needed.
- **Stakeholder analysis**: identify which Armed Forces agencies are affected by the problem. These agencies shall provide SME who will be part of the development team and provide inputs into the OMP analysis.
- **Sponsor**: when there is one, it is the organization that supports the development of the concept to a greater extent. It may be the originator of the problem, or perhaps the one that has accepted under its responsibility a problem proposed by another organization. The sponsor is usually the end user of the concept. They provide SME to the CD&E team for concept development and experimentation.
101. The CDD is the document that formally initiates the concept development process at the CCDC.
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CHAPTER 3. PROJECT MANAGEMENT

1 INTRODUCTION

102. Once the JCP has been approved, and in parallel to the elaboration of the CDD, it is necessary to define the concept project (CD&E project) that shall develop and test the possible solutions to the problem.

2 PROJECT PHASES

103. A CD&E project has the phases described below, although depending upon the initial maturity of the solution, it may not be necessary to go through all of them.

I. Problem Definition. The purpose of this phase is to define the problem\(^\text{11}\) to be solved and the knowledge needed to solve it, the environment in which the problem is located, the solution space and the parties involved.

II. Research. The purpose of this phase is to gather existing explicit knowledge about the problem, about the existing solution in use and about possible alternative solutions, as well as to identify in which areas there is no documented knowledge that should be discovered or developed. It is also of interest to obtain indicators of the problem that could be used as metrics for the experiment. These indicators will allow the establishment of a baseline that could be use later to evaluate whether the concept solves the problem or not. Two main tasks are conducted in this phase:

   a. Bibliographic review. Analysis of existing documentation and ongoing research on the problem to improve its understanding and focus the hypothesis of the solution.

   b. Stakeholder analysis. Extend the study (already started in the definition phase) on which part of the organization is in contact with the problem, who can help solve it, and who is involved in the implementation of the solution.

\(^{11}\) Although the problem is already defined in the OMPP and, subsequently, in the CHOD Directive, this phase deepens the definition, to understand the problem in its full dimension and to narrow it down if necessary.
III. Discovery and development. The purpose of this phase is twofold, firstly, to discover the tacit knowledge that the members of the organization possess, but that is not documented and which is therefore not set out in the Baseline Analysis. If deemed necessary, implicit knowledge from outside the organization may also be sought in this phase. Secondly, to consolidate the knowledge obtained both in the research phase and from the SME, as well as to develop the non-existing but necessary knowledge to solve the problem.

IV. Validation. This phase is about proving that the proposed solutions are valid and that they add operational efficiency to the Force. Generally, the focus of the experimentation is on the major changes that the concept proposes. With the results of this phase, it is argued if the solution is appropriate, that is, that it solves the problem.

V. Consolidation. This phase verifies that the developed solution is appropriate, practicable (can be implemented) and acceptable (its effectiveness or efficiency outweighs the cost and risks); that the concept does not conflict with other areas of conceptual or doctrinal development; and that interoperability with other capabilities is maintained. This is the phase in which Armed Forces agencies will be able to formally comment on the concept.

VI. Implementation: This is not a phase of conceptual development per se, but the concept shall be developed with the idea that once approved it has to be viable; it will have to be materialized in concrete measures to be applied in the Armed Forces. To this end, it is essential that:

a. The Joint Staff Plans Division (DIVPLA) follow up on the development of the concept, as it will lead its implementation in the Armed Forces.

b. That adequate validation experiments have been conducted in which, besides confirming that the solution is appropriate, it is also verified that it is practicable (can be implemented) and acceptable (its efficacy or efficiency compensates the cost and risks).

3 PROJECT TEAM

104. Conceptual development shall be conducted by a project team composed of a Project Manager (from the CCDC), an Experimentation Manager, and multiple SME.

105. The CCDC shall appoint a Project Manager, responsible for forming and coordinating the project team and drafting the concept. He will lead the team throughout the process ensuring the right balance between innovation and feasibility of the solution.

106. The Project Manager is in charge of identifying the SME that will be part of the team and proposing their appointment.

107. The SME are appointed at the proposal of the Project Manager or, failing this, designated by the organizations involved in accordance with the following considerations:

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12 Figure already defined in paragraph 60.
Based on the **principle of participation**, SME from the organizations involved in the activities under study, and others deemed appropriate, shall be invited to participate in the concept development projects.

**Within the Ministry of Defence**, SME from the Joint Staff, the General Directorate for Armament and Material (DGAM), Joint Operations Command, the Services and, in general, all those members of the organization that are considered suitable, knowledgeable and experienced on the subject shall normally participate in the different projects.

In all projects, and following the same criteria of suitability, knowledge and experience of the subject under study and due to the foreseeable added value that they can contribute with, especially in the area of technological innovation, the participation of SME from other agencies of the **General State Administration (AGE)**, the private sector and, in particular, from **academia** and **industry** shall be promoted. The latter shall be identified preferably through the IEEE and the DGAM, respectively, without prejudice to the possibility of using other channels.

108. **The SME shall not represent the appointing agency**; his role will be limited to contributing with his opinions, technical knowledge and experience for the best development of the project.

109. The role of **Representatives** is conducted by COECOn members, who shall have constant access to the evolution of the project through the virtual collaborative platform. They will participate actively only in the consolidation phase, to provide the vision of the authority they represent, to ensure its interoperability.

110. Whenever possible, the working group shall be advised by a **Mentor**, who shall be a professional of recognized prestige in the subject matter in question. He will not participate directly in drafting the document, but rather he will offer his opinions and guidance to the Project Leader on the drafts to be written. At all events, the Head of the Concepts and Experimentation Section shall also perform this function.

111. From the beginning of the project, the project shall be supported by an **Experimentation Manager** (normally from the CCDC) responsible for identifying the experimentation needs of the concept under development, the general design of the experiments, and for requesting the necessary resources from the appropriate authorities that cannot be provided by the technical support agencies.
4 PROJECT PLAN

112. The Project Plan is the document that contains the details of the conceptual development plan according to the CD&E methodology and following the phases described above. At least the following aspects should be detailed in this document:

- **Project schedule**: it must specify the estimated duration of each of the project phases and its main milestones (meetings, events, delivery dates of the different products, revisions, etc.).
- **Resources required**: an initial estimate of the human and material resources required to conduct the project and the allocation to its different phases.
- **Activities**: a list of analysis and experimentation activities planned for each phase.
- **Associated projects**: identification of possible synergies with other concepts (or other projects) under development in the same time period.
- **Communication plan**: identification of stakeholders and the activities planned to keep them informed of the project plan, development, and products.
- **Deliverables**: list of products that are expected to be generated during the development of the concept. As a minimum, the following should be included:
  - **Project Plan.** (Project Manager)
  - **Baseline Analysis.** (Project Manager) Document containing the definition of the problem, the analysis of the operational environment and its implications, the stakeholders and the findings obtained from the bibliographic analysis. Based on these findings, the study topics to be addressed in subsequent phases and the first hypothesis are also proposed.
  - **Experimentation Plan.** (Experimentation Manager) Document that details the design and execution of the experiment. It includes the methodology, objectives, hypotheses to be validated, execution plan, resources needed, scenario, risks (and how to mitigate them) and associated administrative tasks. This document shall also include a data capture and analysis plan detailing what data shall be collected and how it shall be analyzed.
- **Experimentation Report.** (Head of Experimentation) It will collect the results of the experiment, its analysis, the conclusions obtained and how they affect the concept.

- **Concept.** (Project Manager) The end product of the process. Its drafting is an iterative process in which successive versions are generated, consecutively numbered according to the degree of maturity reached, to refine and mature the initial ideas.

### Table 1 - Versions of the concept

<table>
<thead>
<tr>
<th>Version</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>First draft presented to the working group. Founded on the Baseline Analysis and initial comments from SME.</td>
</tr>
<tr>
<td>1.1 to 1.9</td>
<td>Drafts fed back with the results of the working group discussions.</td>
</tr>
<tr>
<td>2.0</td>
<td>The end product of the Discovery and Development phase. Refined document but pending experimental validation.</td>
</tr>
<tr>
<td>2.1 to 2.9</td>
<td>Drafts fed back with the results of the validation experiments.</td>
</tr>
<tr>
<td>3.0</td>
<td>A refined and experimentally validated document. It is distributed to the organization for consolidation.</td>
</tr>
<tr>
<td>3.1 to 3.9</td>
<td>Drafts fed back with official comments from the various agencies concerned.</td>
</tr>
<tr>
<td>4.0</td>
<td>The final version of the concept to be submitted to the CHOD for approval. It shall be used to guide the Implementation Plan.</td>
</tr>
</tbody>
</table>

113. The Project Plan is a **living document that is constantly being revised and updated**. It serves as a guide throughout the conceptual development process and allows for the quantification of possible deviations from the initial plan.

114. To develop this plan, project managers can make use of a template that generically lists the most common activities and their tentative duration:

- **Project Plan Template in MS Project** - 2021

115. It is considered advisable that compliance with the Project Plan and the quality of the products generated be periodically assessed by someone outside the project development. Different methodologies can be used for this task:

- **Red Teaming Handbook** - DCDC - 2021
- **Concept Testing Handbook** - NATO ACT - 2018
CHAPTER 4. EXPERIMENTATION AND ANALYSIS

1 INTRODUCTION

116. A military experiment is a controlled investigation aimed at discovering new knowledge, the acceptance or rejection of a hypothesis or the validation of a solution to a given problem or a part thereof.

117. There are three main types of experiments:

- **Discovery experiments.** The main objective is the extraction of existing and undocumented implicit knowledge to improve understanding of the problem and the search for possible solutions for later validation. It is the most flexible type of experiment and is used in the initial phases of the project. A discovery experiment can answer three types of questions:
  - Why does this problem occur?
  - How do I solve the problem?
  - What would happen if I applied this solution?

There is a wide variety of scientific and analytical methods that enable discovery experiments and they are generally based on exploiting existing knowledge in a panel of experts so it can be used to develop concepts. They are mainly used during the solution design phase and can also be used to refine concepts. The most common formats for this type of experiment are the expert seminars, wargames or table-top experiments.

- **HYPOTHESIS-TESTING EXPERIMENTS.** These are experiments specifically designed to test a theoretical hypothesis. During the development of the solution of an OMP, statements or hypotheses will be generated that will establish relationships between the variables involved in the problem. These hypotheses require empirical verification by means of a hypothesis test. A hypothesis test statistically tests the veracity of the hypothesis stated and takes the form IF...THEN, composed of two clauses, A and B, which is generally stated in the form:

  \[ \text{If I apply Treatment A to an Experimental Unit, then I get Effect B.} \]

This type of experiment requires a strict design, a highly controlled environment, and a rigorous data collection and analysis plan. It is useful to support the solution development, refinement, and validation processes.

- **Validation experiment.** These experiments aim to demonstrate that the implementation of a solution produces an improvement in the effectiveness of military operations, usually by comparing the proposed solution with existing capabilities. Validation experiments require a controlled environment and structured data collection to provide the evidence to assert, with some degree of certainty that the concept provides a solution to the problem posed in an operational context. They are useful during the solution refinement, evaluation and validation phases, and can be performed either in controlled environments or in real exercises or operations.
2 MANAGEMENT OF AN EXPERIMENT

118. Experimentation is fundamentally a controlled activity. The experiment design must explicitly describe which variables are to be controlled and which variables may be left uncontrolled, albeit recorded. However, simply listing which indicators are to be measured is not sufficient. This control must be exercised throughout the planning and execution phase of the experiment.

119. **Design.** The design process is a logical journey from the questions to be solved or hypotheses to be tested, to the detailed definition of the experiment. Therefore, the design is the key piece of control since it sets out in broad terms what needs to be done. Success in the design of the experiment lies in setting out, from the outset and clearly, what the objectives and intentions are. The design of the experiment should be reflected in a document called the Experiment Design Document (EDD).

120. **Planning.** Planning requires a team that makes the necessary high-level decisions, oversees the activities of the different teams, and ensures that the planning and organization of the experiment develops toward the objectives in a timely manner.

121. **Execution.** The planning team becomes the control team during the execution of the experiment. The role of the controllers is to ensure that the experiment is progressing according to plan, and to amend the development if this does not happen. The controller observes the participants, records their perceptions, and works with the analysts to monitor the progress of the experiment. The controller provides feedback to the experiment director and implements changes as necessary to ensure that the event achieves its intended objectives. Moreover, the controller must be receptive to the value judgments and observations of the participants, and to the scientifically objective comments of the analysts.

122. **Analysis.** The analysis team for an experiment should ideally be drawn in part from the experiment design team and work closely with the concept developers and the team responsible for providing the technical environment for the experiment. They should prepare a data collection and analysis plan that meets the needs of the experiment design.

123. During the execution of the experiment, and as sufficient data become available, analysts should refrain from announcing major findings or conclusions because, when the analysis is completed, they are likely to vary significantly.

3 DISCOVERY EXPERIMENTS

3.1 PURPOSE

124. The purpose of a discovery experiment is to obtain new knowledge about a military problem or its solution. A discovery experiment aims to **convert implicit knowledge that exists in the organization into explicit knowledge** that can be used in concept development.

125. Depending upon the outcome of the research phase, we may encounter different types of questions that shall guide the focus of the experiment:
Table 2 - Focus of discovery experiments

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
<th>Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unknown</td>
<td>Unknown</td>
<td>Why does this problem occur and what is its origin?</td>
</tr>
<tr>
<td>Known</td>
<td>Unknown</td>
<td>How do I solve the problem? How do I do this?</td>
</tr>
<tr>
<td>Known</td>
<td>Hypothesis</td>
<td>What would happen if I applied this solution? And, would it work well?</td>
</tr>
</tbody>
</table>

126. Discovery experiments can be used to make progress on the problem, when it is not well understood, to explore solutions to the problem, when its origin is known, or to theorize about possible solutions, if a solution thesis could be developed from the investigation.

127. To the extent possible, concept working group meetings should be approached as discovery experiments (with their methodology and data capture and analysis plan) rather than as conventional committee meetings.

128. A discovery experiment is only as good as the experts who participate in it. This is the main resource of the experiment and the validity of its results depends upon the quality of these SME.

3.2 TYPES

3.2.1 Directed Discussion

129. This is the simplest form of experiment. It involves bringing together a group of SME and presenting them with a problem to analyze or develop a solution through brainstorming sessions, or presenting them with a solution for them to critique its validity and propose ways to improve it. The difference with a conventional seminar is that in the experiment a data capture plan is prepared and the data shall be analyzed quantitatively and qualitatively by the analysis team.

130. Guided discussion experiments are particularly useful for exploring new nuances or aspects derived from a solution, as well as for analyzing and decomposing it. A guided discussion is nothing more than an exchange of ideas, in which the participants present their points of view under the guidance of a moderator with the aim of discovering new solutions or analyzing existing ones as a group, within the problem posed. It is said to be “directed” because the moderator focuses it on the aspects on which knowledge is to be discovered and avoids discussions on aspects that have already been sufficiently proven in the previous research phase.

131. Discussion Groups: is a type of guided discussion in which the SME, instead of discussing in a single group, are distributed in different groups, each with a specific task (use the solution, criticize the solution, etc.).
132. In the following reference, multiple methods and techniques applicable to directed discussions (and other discovery experiments) are described:

![The NATO Alternative Analysis Handbook - December 2017.](#)

### 3.2.2 Wargaming or table-top

133. A wargame-type experiment **reproduces an operational situation** for an experimental unit to apply the solution. In the design of the experiment, indicators are introduced so that when the solution is applied, metrics on the applicability and effectiveness of the solution can be captured. Simultaneously, analyst observations are collected to complete the metrics and, at the end of the experiment, participants’ impressions on the ease of use of the proposed solution are also collected.
134. **Table-top** is a *simple simulation of a process*, in which the various actors involved sit at a table and successively execute their roles in the process in view of a situation presented in a specific scenario. The analysis group captures the metrics and incidences of the process. It has the advantage of being able to be executed with few technological means.

135. There are a multitude of methodologies for table-top experiments and wargames depending upon the objectives sought. The following are some of the most important references:

- Wargaming Handbook - DCDC - 2017
- Concept Development Assessment Game (CDAG) Handbook - NATO ACT - 2014
- Disruptive Technology Assessment Game (DTAG) Handbook - NATO ACT - 2016
- Practical Advice of Matrix Games - Maj. Tom Mouat - 2020

### 3.3 ANALYSIS

136. Analysis seeks to learn within the scope of the experiment how an aspect of the solution contributes to solving the problem. Generally, each topic under study becomes an **Analysis Objective** of the experiment, and for each objective, a series of **Essential Elements of Analysis (EEA)** are developed.
137. The EEA are the different aspects of each objective that serve as the main elements of the analytical focus and allow assessing the goodness of the proposed solution. The EEA are formulated such that when properly answered they provide answers that allow the objectives to be analyzed. They usually require narrative responses. The quantitative results of the analysis are combined with value judgments captured in the context of the experiment to produce meaningful responses.

3.4 DEVELOPMENT

138. For each EEA there shall be a series of ideas in question drawn from the concept. Each of the ideas is introduced by the moderator or facilitator to the discussion group. During the discussion, both participants and analysts can enter comments into the data capture tool, expressing opinions or suggesting new ways of approaching the solution. At the end of the discussion, the participants shall have formed an opinion on the idea discussed. This opinion is formally collected after the discussion by means of a survey that captures the degree of acceptance of the idea.

139. Both data captures, the comments and the survey, give a qualitative and quantitative perspective of the discussed idea which, after analysis, serves to feed back into the concept, accepting the idea, expanding it, modifying it or rejecting it.

140. Discussions of these experiments are normally conducted under the Chatham House Rule\textsuperscript{13}, which is used worldwide as an aid to free discussion, encouraging anonymity of participants and their opinions to foster openness and exchange of information.

<table>
<thead>
<tr>
<th>Chatham House Rule:</th>
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</thead>
<tbody>
<tr>
<td>When a meeting, or part thereof, is held under the Chatham House Rule, participants are free to use the information received, but neither the identity nor the affiliation of the speaker(s), nor that of any other participant, may be revealed.</td>
</tr>
</tbody>
</table>

141. Merriam-Webster’s Dictionary defines “facilitate” as “to make (something) easier: to help cause (something); to help (something) run more smoothly and effectively.” In the field of experimentation, “facilitating” is the process by which a group is helped to achieve its objectives by mobilizing its potential and minimizing interaction problems. The person in charge of this process is called a facilitator.

142. The facilitator is a key resource in any discovery experiment. He must be more than just a moderator of the discussion as he not only manages the timing of the interventions, but also actively encourages the participation of all SME to contribute their potential and guides the discussion towards its objectives so that it produces the data needed by the analysts.

143. The facilitator’s job is more of an art than a science, and basically consists of:

- Creating an appropriate environment for communication and dialogue.
- Catalyzing the exchange of information using appropriate tools.
- Promoting consensus and mediate disagreements.

\textsuperscript{13} For more information, see https://www.chathamhouse.org/about/chatham-house-rule.
3.5 RISKS

144. During all phases of the experiment, from planning to analysis, there are a number of risks that can jeopardize the validity of the experiment. The presence of these risks must always be borne in mind and it is therefore essential to plan measures to mitigate them.

145. The main risks common to this type of event are:

- **Lack of knowledge of the problem on the part of the participants.** The participants come from different organizations, they may or may not have the necessary training and experience to contribute; even if they have the necessary general knowledge, it is possible that, due to their job position, they may be working in areas not directly concerning the problem and may not be aware of the details to be discussed.

- **Different motivation or preconceived ideas on the part of the participants.** Participants come from different organizations and will not only have different backgrounds and experience, but will also have different motivations for participating. To mitigate this risk, the analysis team should introduce control indicators in the surveys to detect deviations in the answers provided by the SME.

- **Experts cannot contribute with their knowledge to the discussion.** To minimize this risk the facilitator shall allocate time, ensuring that all SME participate in the meeting. Moreover, the data capture tool shall have the functionality to enter free comments.

- **The discussion is not representative.** It is possible that the discussions are inadequate to generate sufficient criteria in the attendees to answer the questions rigorously. It is also possible that the ideas presented, although valid, do not serve to answer the EEA.

146. At the end of the event, if the required areas of knowledge were brought together, if the SME had the opportunity to contribute with their knowledge to the discussions and if these discussions are considered relevant to the analysis of the proposed solution, it can be concluded that the result of the experiment is relevant to the study in question.

4 HYPOTHESIS-TESTING EXPERIMENTS

4.1 PURPOSE

147. During the research and discovery and development phases, possible solutions will be generated and will take the form of theoretical assertions or hypotheses. When these assertions cannot be verified or rejected through direct observation, they should be tested to verify their veracity.

148. The purpose of a hypothesis testing experiment is to fill a specific knowledge gap by means of a strategy designed to make decisions, the hypothesis test. A hypothesis test makes it possible to decide whether a proposed idea should be retained or whether it should be rejected.

149. From each theoretical hypothesis, a scientific hypothesis shall be stated, which must be empirically verifiable and which usually takes the following form:
These experiments are valid for rejecting ideas that do not work and retaining those that do work, either individually or by comparison between them, and shall generally be used in the development phases and or as part of a validation experiment during the validation phase of a concept.

4.2 COMPONENTS

Every hypothesis testing experiment has the following components.

- **Treatment.** It is the capability or condition that can influence the effectiveness of military operations. It is reflected in clause A of the hypothesis.
- **Effect.** It is the result of applying the treatment, that is, it is the improvement in the effectiveness of military operations that occurred when the treatment was applied. It is reflected in clause B of the hypothesis.
- **Experimental units.** The units to which the treatment is applied to produce the effect.
- **Experimental model.** It is a representation of the solution, which executes the experimental unit and on which the treatment to be tested is applied. It is important that this model is representative of that solution, so its validity must be somehow argued and its performance verified.
- **The trial.** It is the manipulation of the values of capability A to observe how effect B is produced, within a controlled environment.
- **Analysis.** It is the comparison of the results of the different trials.
- The **scientific hypothesis.** It is the operationalization of the theoretical hypothesis setting out the relationship between the variables in a way that is empirically contrastable: “If I use capability A, the effect is greater than if I use capability B”.
- The **statistical hypothesis**: It is the statistical representation of the measured hypothesis including the parameters that are compared to determine the existence of the hypothesized effect: $\mu_{\text{effctA}} > \mu_{\text{effctB}}$
- **Empirical evidence**: it shall be provided by the data obtained from the experiment designed to test the scientific hypothesis.
- The **decision rule**: it is based on the degree of compatibility, in probabilistic terms, of the data obtained with the hypothesis proposed.
5 VALIDATION EXPERIMENTS

152. This section presents the fundamental aspects of validation experiments. For further information on the subject, the following references are recommended:

| **Guide for Understanding and Implementing Defense Experimentation (GUIDEx) | Pocketbook | Brochure** | TTCP - 2006 |
| **The Practice of Military Experimentation** | CNA - 2003 |
| **The Art of Military Experimentation** | CNA - 2004 |
| **Code of Best Practice for Experimentation** | CCRP - 2002 |
| **The Logic of Warfighting Experiments** | CCRP - 2006 |
| **Code of Best Practice - Campaigns of Experimentation** | CCRP - 2005 |

5.1 PURPOSE

153. The purpose of a validation experiment is to **compare the performance of the new capability with that of the old capability**, to prove the hypothesis that the new capability provides better performance.

154. One or more hypothesis-testing experiments may be integrated.

155. These experiments are valid for debugging more mature versions of a solution or for contributing to the validation process of the new capability, but are not suitable for the early stages of concept development.

5.2 VALIDITY

156. For an experiment to be valid, and therefore useful to develop a capability, four requirements must be met:

**I. Usability of the new capability.** In practical terms, this means that the concept and tools to be tested are fully operational in the experimental unit. The main threat is that the new means or procedure would not be used, or would not work properly, or could be underused because personnel are not sufficiently trained.

**II. Ability to detect change.** This refers to being able to detect a change in clause B of the hypothesis, for which it is necessary to define measurable performance indicators. The design of the experiment should make possible to appreciate the difference between using and not using the experimental capability. To appreciate the effect is to detect a simultaneous variation of effect B when manipulating capability A. Simultaneous variation means that the effect varies systematically when the capability varies. Two problems can arise from such detection: not appreciating a real change, and appreciating a change that does not exist. These problems arise for the following reasons:

- **Capability performance.** Erratic performance of the capability that produces erratic variations in effect.
• **Differences among participants.** Some are more efficient than others and distort the result in one direction or another. Solution: equalize the samples of participants as far as possible.

• **Trial conditions.** The different trials were not conducted under the same conditions.

• **Data collected.** Incorrect choice of data that does not allow to determine if there was a change in performance. Data sample is too small to draw conclusions.

• **Ability to analyze.** A variation is detected, but it is impossible to decide whether it is within or outside the random variation of the phenomenon.

**III. Possibility of isolating the cause of the change.** That is, to prove that the change in B has been produced by the change in A. For a relationship to be considered cause-effect, at least three conditions must be met:

- The cause preceded the effect.
- The cause concerns the effect.
- An alternative explanation to the cause for the effect cannot be found. The main threat to this requirement is the possibility of finding an alternative cause that may have led to the effect. This usually arises because variables were left uncontrolled in the experimental design:
  i. Differences between experimental units (preparation, motivation, evolution, etc.).
  ii. Differences in data collection from different trials.
  iii. Differences in trial conditions (OPFOR behaves differently, the information they receive is different, etc.).

**IV. Generalizability of the results to actual operations,** that is, whether the change in performance B, caused by capability A, also occurs in actual operations. The main risk to this requirement is that the observed change is not applicable.

For the results to be extrapolated to real operations, the experiment must have been performed realistically. The reasons why an experiment loses realism are as follows:

- The capability is not realistically implemented. The organization or prototype is not translatable to actual operations.
- The experimental unit is not representative because of its composition, training, capability or motivation.
- The measurements are not representative, and the performance measured cannot be extrapolated to reality.
- The scenario is unrealistic in its layout, in the behavior of own forces, that of enemy forces, or in the player’s familiarity with it.

157. In short, a **valid experiment** may be defined as an **experiment that provides solid evidence to ensure the truth or falsity of the causal proposition** stated in the experimental hypothesis. The first three requirements determine the internal validity of the experiment, the ability to determine whether a cause-effect relationship exists between the two variables. The fourth requirement represents the external validation of the experiment, the possibility of generalizing the cause-effect relationship found in the experiment, extrapolating it to reality.
### Table 3 - 21 Threats to the validity of an experiment in defence (GUIDEx)

<table>
<thead>
<tr>
<th></th>
<th>1. Possibility of using the new capability</th>
<th>2. Ability to detect change</th>
<th>3. Possibility of isolating the cause of the change.</th>
<th>4. Ability to relate results to actual operations.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Single group</td>
<td>Multiple groups</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>2. Experimental Unit</td>
<td>2. Participants do not use the capability</td>
<td>6. Variability of participants</td>
<td>12. Participants vary over time</td>
<td>15. Differences between participants from different groups</td>
</tr>
<tr>
<td>4. Essay</td>
<td>4. Capability is not exercised</td>
<td>8. Variability in test conditions</td>
<td>14. Test conditions vary over time</td>
<td>17. Differences in test conditions in different groups</td>
</tr>
<tr>
<td>5. Analysis</td>
<td>N/A</td>
<td>N/A</td>
<td>9. Low statistical power</td>
<td>10. Violation of statistical assumptions</td>
</tr>
</tbody>
</table>
5.3 DESIGN

158. The following diagram shows the different stages of a validation experiment:

![Diagram: Hypothesis validation experiment]

**Figure 12 - Hypothesis validation experiment**

I. **Problem**: Problem definition is the beginning of any experimentation campaign. Problem identification may arise from lessons learned from actual operations, exercises or seminars.

II. **Model**: The concept is a vehicle for exploring solutions to the given problem, which should ultimately provide the capability that would solve the problem. For any experiment, it must be clearly defined which feature of the concept is the focus of the experimentation. From this focus, a model must be developed that represents the part of the solution to be tested. It is essential that this model has the level of detail necessary for the test to be conducted. Thus, the model must be validated, that is, it must be verified that it is representative of the solution, and verified, that is, it must be verified that it works correctly.

III. **Hypothesis**: It sets out the purpose of the experimentation, in its clause A it indicates the capability to be tested, and in its clause B the improvement expected to be obtained. The experiment is aimed at testing the veracity of the hypothesis.

IV. **Metrics**: To test the hypothesis it is necessary to choose indicators to assess whether the performance of the operations improved. These indicators should be chosen so that the change can be seen throughout the experiment and a data collection plan should be prepared to measure their values throughout the experiment.

V. **Trials**: The manipulation of the values of capability A to observe how effect B is produced, within a controlled environment. To execute the trials, it is necessary to define:

   - **Scenario**: the scenario defines the operational context of the trial. It should be chosen considering the purpose and objectives of the experiment. To design the scenario it is necessary to define:
     - Geographic area.
     - Force structure and equipment.
     - Level of detail of the units.
• **Personnel**:
  - Participants: those who participate as components of the experimental units.
  - Controllers.
  - Analysts.
  - Technical support team.

• **Technical architecture**
  - Communications.
  - Networks.
  - Computers.
  - Databases.
  - Modeling and simulation.

• **Data collection**. There should be a plan that determines what data should be recorded, how often, and what recording mechanism shall be used.

VI. **Analysis**: This is the comparison of the results of the various trials to determine if there is a relationship between the manipulation of capability A and the changes that occur in the B effect.

159. It is recommended that the design process of the validation experiments run parallel to the development of the concept and that the SME of the working group actively participate in its definition.

6  **DATA CAPTURE AND ANALYSIS**

160. Every experiment must have a data capture and analysis plan.

![Figure 13 - Data capture and analysis plan](image)

161. **To analyze** is to interpret the information to draw conclusions and combine them with existing information to extract new insights. This is one of the main challenges of an experiment.

162. Beginning with the hypothesis, what needs to be analyzed is determined and, taking this into account, what needs to be measured. It must also be decided which techniques of analysis shall be used, generally statistical techniques of analysis.

163. The analysis plan ensures that the necessary data will be generated and that the key aspects of the experiment shall be addressed. Once the technique of analysis to be used has been decided upon, an estimate of the number of observations needed must be made, depending upon which will depend upon the number and variability of the dependent variables. It is essential to prioritize and ensure that there are sufficient observations for all the objectives, measures of performance (MoP) and measures of effectiveness (MoE) to be analyzed.
6.1 ANALYSIS OF EXPERIMENTS

164. Analysis is the process of learning what you want to know from what you already know or can be known. It is a crucial part of any experiment. The analytical challenge is to organize the results of experimentation and integrate them with existing knowledge to generate new and valid knowledge.

165. A more extensive explanation of the techniques of analysis can be found in the following references:

Joint Analysis Handbook - NATO JALLC - 2016

166. In essence, and regardless of the type of experiment, the analysis team does the following:

- Study the problem, compare the proposed solution in the concept with the existing capabilities and obtain what is the added value and what is the difference between the proposed solution and the existing capability. To test this difference (improvement) provided by the proposed solution, the Analysis Objectives of the experiment are developed.
- Develop each analysis objective in Essential Elements of Analysis (EEA, already defined in section 3.3).
- Develop for each EEA the metrics to measure the added value of the new solution, establishing the value that provides the current capability and what would be the value that would indicate that the new solution is valid. It is a half work between the SME and the mathematician.
- Design the experiment in such a way that the necessary data can be captured to obtain the proposed metrics. This can be done simply with the intention of obtaining an initial assessment of the goodness of the solution (discovery), with the intention of comparing with the baseline situation (hypothesis testing), or with the intention of testing performance in a realistic environment (validation).
- Once the data is captured and metrics are obtained, they are analyzed with the appropriate techniques to make recommendations for improvement or validation of the concept.

6.2 DATA ANALYSIS PLAN

167. The analysis plan takes its form from the underlying conceptual model of the experiment.

168. Specific measures are important because they provide information about the level of measurement (nominal, ordinal, interval or ratio) available for each variable of interest. These levels of measurement, in due course, will help determine the appropriate analytical technique to apply.

169. The analysis is normally organized in three phases:

- Descriptive analysis of individual variables,
- Bi-variate analysis of relationships and
- Multi-variable analysis of major patterns.

6.3 DATA CAPTURE PLAN

170. The data collection plan includes all the variables to be collected, all the locations where they are to be captured, all the means of data capture and all the sites where the data shall
be stored for processing. This shall be captured in a document incorporating both the design of the plan and the details of the collection.

171. A high-quality data collection plan also specifies the support required, the training needed, the competency standards to be met, the quality control, how to archive the data to ensure its integrity, and the process by which data sets shall be reduced from their coarser state to create sets of variables devised from the Analysis Plan and assembled for efficient analysis.

172. The creation of the data collection plan can be thought of as a sequential task, although in reality it is found to be iterative because it is strongly linked to the objectives of the experiment, the scenario, the physical spaces available, the systems to be used to support the experiment, and other factors that are likely to change from the initial concept phase through the pre-testing phase.

173. The key steps in this process are:

- Specification of the variables to be collected.
- Identification of data collection mechanisms for each variable.
- Specification of the number of observations required for each variable and verification that they are indeed generated.
- Identification of personnel training to ensure the quality of data collection.
- Definition of data processing processes.

174. The types of data collection mechanisms normally used in experiments are:

- **Automatic collection.** Automatic collection systems are becoming increasingly important; when several different systems are used, it is important to synchronize their clocks so that the data are comparable.

- **Manual data recording.** It is important that all data collectors use the same time base, and that they have been properly trained beforehand so as not to introduce variability in data capture.

- **Observers** who capture interactions between participants. For example, they take notes on what is happening, noteworthy behaviors, and other such activities. Observers can also be used to document what happened during the experiment. This provides information that can be used to explain why certain results were obtained.

- **Surveys** can be used to gather information of various kinds about the experimental unit, their experience, their perceptions of the experiment, strengths and weaknesses of the systems and processes, as well as suggestions for improvement.

- **Comments from participants.** The experiment’s audience enters their impressions into a data capture tool. They are generally used in conjunction with surveys.

175. Each one of them has its particular use, strengths, weaknesses and factors that need to be considered before use.

### 6.4 RELATIONSHIP BETWEEN THE ANALYSIS PLAN AND THE CAPTURE PLAN

176. The fundamental purpose of the data collection plan is to feed into the analysis plan. The work process should begin with a data analysis plan to determine how the issues to be studied are to be addressed with the data generated by the experiment. Thus, the data
collection plan can be understood to act as the supplier to the analysis plan, which acts as the consumer.

177. While the requirements of the analysis are the benchmark, the reality is that practical factors (access, minimizing interference, classification, etc.) may limit what can be collected in an experiment. Therefore, while the analysis should be positioned first, the development of the two plans should be iterative and ongoing.

178. The purpose of the data collection plan should be to provide what is needed in the Analysis Plan. To ignore this principle means that data that are easy to obtain might be collected instead of those that are necessary for a valid experiment that contributes to the growth of knowledge.

179. Finally, the experiment team needs to remember that neither of these plans is an end in itself. They are both instruments for achieving the overall objectives of the experiment. As such, they are subject to and must adhere to the rest of the experimental plan.

180. The data collection plan should be coordinated with the scenarios, with the pre-testing, with the training plan for the data collectors and with the systems used to archive the data and information.

181. The analysis plan should be organized from start to finish, from pre-test debugging to post-experiment analysis and modeling.

7 ADVANTAGES AND DISADVANTAGES OF CONDUCTING EXPERIMENTS DURING EXERCISES

182. The reason for conducting experiments during training exercises is that it is very difficult to gather the necessary resources for an experiment, as no country usually has dedicated experimentation units. This initial consideration aside, there are advantages and disadvantages to this practice.

183. For a more complete explanation of the recommendations to be borne in mind in the use of exercises for experimentation, see the following reference:

Experimenting in Exercises. A Short Guide - NATO ACT - 2016

7.1 ADVANTAGES

- Participants usually take the exercise seriously, and try to get the most out of the capabilities made available to them. If the exercise is held with a real opposing force, motivation is increased by the desire to “win” the battle. This can act as a double-edged sword for an experiment: participants shall use the capability under experimentation, getting the best out of it, if they think it helps them “win” and, conversely, shall discard it if it hinders their performance.

- Any exercise is a controlled environment in which observations are made, data are collected and a critical judgment of results is made. The observations and conclusions can be useful for the analysis of the experiment.

- Participants are generally a representative sample of the military population.

- If the exercises are performed periodically, there is past performance data that can be used as a benchmark to compare the performance of the new capability.

- The results obtained are easily extrapolated to real operations.
7.2 INCONVENIENCES

- The scenario may not be suitable for the experiment in question, and there is usually little chance of influencing its design.
- The scenario may contain artificialities to increase training, for example, forced confrontation situations, over-performance of enemy capabilities, etc.
- The control group may intervene in favor of the training objectives, distorting the realism of the exercise from the experimental point of view.
- Progression in training. Participating units may not have the necessary training to be representative (that is why they are being trained).
- Intrusion. The experiment may have a negative impact on the development of the exercise, even denying the achievement of the training objectives, especially in those participants involved in the use of the new capabilities.
PART II - PROJECT PHASES
CHAPTER 5. PROBLEM DEFINITION

1 OBJECTIVE

184. As already mentioned in the first part of the document, this phase seeks to delimit the problem to be solved and the knowledge required to solve it, the environment in which the problem is located, the solution space and the parties involved.

185. To do this, the first step is to model the problem. A model is nothing more than a logical interpretation of reality that allows us to better understand it and to highlight our assumptions. Generally, after modeling the problem, the solution becomes more evident and can also be modeled.

2 ACTIVITIES

2.1 PROBLEM DELIMITATION

186. To narrow down the problem the Project Manager should try to answer the following questions:
   - What is to be investigated?
   - Who is the proponent of the OMP?
   - What knowledge is needed to tackle the project?
   - What means can the proponent contribute to the development of the concept?
   - At what level of detail should the solution be developed (concept note, basic concept, exploratory concept or operational concept)?
   - What products will result from the research?
   - Who will use these products?

187. For this purpose, it will start from the OMP statement and the CHOD Concept Development Directive and will conduct the necessary preliminary analyses.

188. With this information, a project plan must be developed to determine which stages of the CD&E process need to be conducted and which events need to be included in each of these stages.

2.2 IDENTIFICATION OF SUBJECT MATTER EXPERTS

189. Once the problem has been delimitied, it is necessary to identify those people who, by the nature of their work or their previous experience, have relevant knowledge in the area of study of the concept. Depending upon the characteristics of the problem posed, it may be necessary to seek SME from outside the organization (public administration, academia, industry, etc.).

190. If specific individuals cannot be identified, it will be needed to identify which units or agencies (or subdivisions thereof) are most affected by the subject matter. This will serve to guide the Army, the Navy and the Air Force and other agencies in the designation of SME.
3 DELIVERABLES

3.1 CONCEPT DEVELOPMENT DIRECTIVE (CDD)

191. As indicated in CHOD Communicated Instruction 10/21 for Joint Concepts Development, the CHOD will provide guidelines for the development of the concept, give orientation about the development of the solution and establish the necessary support structures by issuing a CDD.

192. The same instruction states that the responsibility for drafting the CDD lies with EMACON, through the Concepts and Experimentation Section of the CCDC.

193. This directive should have the following sections:
- Background.
- Problem statement.
- CHOD vision.
- Solution space.
- Stakeholder analysis.
- Sponsor.

194. The detailed content of each section can be found in 3.3 of Chapter 2.

3.2 PROJECT PLAN

195. Once the CDD has been promulgated, the first step in the concept development process is to draft the Project Plan. This document is described in detail in Chapter 3 and, at a minimum, should include the following elements:
- Stakeholders and potential sponsors of the concept.
- List of deliverables.
- Temporal plan of activities, milestones and products.
- Initial estimate of resources required.
- Associated projects.
- Communication plan.

196. **Experimentation activities** that run parallel to concept development, supporting the research, discovery and development phases, deserve special mention. Generally, it is not necessary to experiment a concept in all its phases. In developing the project plan, the Project Manager will introduce experimentation events as deemed necessary to support the various phases of concept development, depending upon the nature of the concept and the degree of maturity of the proposed solutions. Some suggestions that may be useful in certain phases are:
- Research: seminars and surveys.
- Discovery and Development: table-top exercises and brainstorming.
- Validation: table-top exercises and wargaming.
- Consolidation: Discussion groups and validation experiments.

197. The elaboration of the Project Plan in MS Project format (from the existing template) can be helpful for the drafting of the document and for the subsequent monitoring of the project.
3.3 REQUEST FOR SUBJECT MATTER EXPERTS

198. Once the SME who, at least initially, will make up the project’s working group have been identified, the corresponding official requests must be sent to their organizations or administrations so that they can formally designate them and authorize direct contacts.

4 PHASE END

199. The problem definition phase can be completed once the Concept Development Directive is approved and the Project Plan is finalized.
CHAPTER 6. RESEARCH

1  OBJECTIVE

200. Research is understood as the set of intellectual and experimental activities conducted in a systematic way with the purpose of increasing knowledge on a given subject. Research is, in essence, the process of solving a problem that culminates in one or more conclusions. The result represents the researcher’s answer to the problem and may be an absolute solution, such as a mathematical equation, or the finding that there is no definite answer, so it is necessary to develop it.

201. The bulk of the research is usually based on a literature review, also called documentary research or bibliographic research, which consists of an analysis of existing documents on the given problem. Previously, a selection process must be conducted to ensure that the documents dealt with are the most relevant to the problem.

202. As a result of this literature review, a series of findings are obtained. The findings are proven and documented facts that tell us how the state of the art is. They are generally divided into findings concerning the current model of the environment, to the problem or its origin and to the theses of the possible solution.

203. The analysis, that is, the reflection and argumentation to generate hypotheses, will begin on these findings. This part of the research is the one that may be subject to discussion and contrast and may require experimentation methodologies.

204. In the case of an academic research paper, the argumentation is aimed at proving the hypothesis put forward. If the research has been used to document the baseline analysis of an experimental project, the research concludes by showing what is known and what is not known about the problem and its solution, and what additional topics of study need to be analyzed to move toward the solution of the problem.

2  ACTIVITIES

2.1  LITERATURE REVIEW

205. The purpose of this activity is to extract and analyze all the published knowledge concerning the military problem under study. To this end, we will try to gather all the documentation concerning the problem, generated both by the AF and by other organizations, seeking to reach a clear understanding of the problem to be solved, determine the current state of research on the problem, identify which aspects are pending solution (questions), which are the study topics to be addressed to solve these questions and formulate the first hypotheses on possible solutions.

206. A question is a shortcoming affecting the problem that has been discovered during previous investigations. They may be stated in the form of lessons learned or findings from other types of reports.

207. Through this process we will try to divide the general problem into several smaller problems that will be ordered by relevance. Each of these problems can be partially solved and finally integrate the partial solutions into a general solution.
208. Partial solutions already developed by others may also be found, which can be incorporated into the conceptual development.

209. The result of this phase is a report with the bibliographic analysis conducted and a prioritized list of the problems identified.

2.1.1 Compilation of documentation

210. The first step in the process is the collection of documentation concerning the problem. This process should be systematic and as complete as possible. The following is a non-exhaustive list of documents to be collected:
   - Doctrinal publications (national and foreign).
   - Conceptual developments (national and foreign).
   - Mission reports.
   - Campaign reports.
   - Analysis of operations and exercises.
   - Seminar results.
   - General Staff Course thesis.
   - Papers from specialist journals.
   - Scientific publications.
   - Handbooks.
   - Books.
   - Online publications.
   - Etc.

211. In the CCDC’s collaborative platform there is a Database of References and Online Publications that can be useful for gathering information on the concepts' topics.

   Database of References and Online Publications - 2021

2.1.2 Document selection

212. The next step is to select, from among all the documentation provided, that which is of real interest for the concept. To this end, the criteria for selecting the literature to be reviewed are set out, so that all of it is relevant and effort is saved in the subsequent analysis. Some of these criteria could be:
   - **Originator.** The originator of the document must concern the problem in some way or have sufficient academic credibility.
   - **Classification:** The security classification of the documentation should be in accordance with that foreseen for the concept.
   - **Publication date.** In most cases, it is desirable to set a maximum age for documents to ensure that their content is still relevant to the current problem.
   - **Scenario.** Because of their particular conditions, not all scenarios may be suitable for drawing conclusions.
2.1.3 Documentation assessment

213. Once the pieces to be analyzed have been selected, an initial assessment of their validity must be made, which will allow the conclusions that can be drawn from each document to be put into context. For example, an official document will not have the same value as an opinion article. Some aspects to bear in mind may be the following:

- Relevance of the subject to the problem.
- Credibility of the author.
- References used in the document.
- General evaluation of possible conclusions.

2.1.4 Individual analysis of each document

214. This is the most important and difficult part of the analysis process. Each document should be read with the three parts of the problem statement in mind, and what it contributes to defining each should be analyzed. A series of findings should be extracted from the individual reading of each document.

215. Findings are pieces of information referenced to a document, which contribute to define the problem or model under investigation. By discovering the relationship between these findings, knowledge about the problem and the possible solution is built and it is determined what part of them is unknown. The necessary knowledge that has not been found in the research must be built in the later phases of the concept development by means of creative techniques.

216. The findings can be divided into three groups:

- **Findings about the problem.** They describe the environment and how the problem manifests itself or even its origin within that environment.

- **Findings on the current model.** These describe the starting point, that is, how the problem is currently being addressed. It is common to include in this section all the national and international regulations governing the activity in question (legal, conceptual or doctrinal).

- **Findings on the possible solution.** If there are already proposals on how to solve the problem or any of its parts, they can be incorporated into the development of the solution sought in the form of a hypothesis.

217. In parallel, the findings shall also be classified according to their estimated degree of certainty:

- **Facts.** Evidence already demonstrated. They constitute the basis of existing knowledge on the subject. They come mainly from official documents.

- **Assumptions.** Assertions that are assumed to be true. They are based on deductive or inductive logic in the face of similar facts. They are difficult to prove, although observable over time. Assumptions help to complete the knowledge of the subject where no evidence has been found. Because they are unproven, they must be validated by the group to ensure that the model is built on accepted assumptions, which shall not be subject to further discussion14.

14 Even if they are not discussed, they should be checked on a recurring basis to ensure that the assumption remains valid throughout the process.
• **Questions.** These are knowledge gaps. They generally concern the challenges in implementing the current model and are formulated by a question that begins with “How...?” The answer to these questions is usually obtained in the development phase.

• **Hypotheses.** These are proposals about a possible solution to a problem. Their main feature is that they can be falsified, that is, they can be tested and proven false by experimentation. Hypotheses generally derive from research papers.

218. To conduct this activity, it is advisable to have a reference management software that allows you to classify, organize and label documents (and citations within them). When working with few documents, this process can be done manually, but when the number of documents grows, it becomes very complicated. Moreover, using this type of software would make it possible to maintain traceability between findings and their origin, and to perform searches on specific topics throughout the CCDC’s document database.

### 2.2 BASELINE ANALYSIS

219. A list of findings shall have been obtained from the literature review. The analysis to be conducted will consist of the interpretation of the findings to discover the interrelationships between the facts and the assumptions, and thus obtain the laws of behavior that allow the conceptualization of the problem. To advance towards the possible solution, the hypotheses are developed and the questions found are answered.

220. As an initial part of this analysis, it is necessary to **assess the findings** to determine which of them are valid and what their relative priority is. This phase can be done with the help of statistical techniques. The result is a prioritized list of findings.

221. To assess the validity of a finding, we can analyze the frequency with which it appears in the bibliography and the value we assign in the evaluation of the documentation in which the finding is identified. These criteria will also serve to resolve contradictions that may appear between findings in different documents.

#### 2.2.1 Summary of results

222. Synthesis is the **integration, evaluation and interpretation of the findings** of the previous phase, so that those found for a specific scenario can be grouped by nature or characteristics, so that they can be conceptualized to become a generic aspect of the problem. In short, it is a matter of putting the quantitative results of the two previous phases into context.

#### 2.2.2 Proposed solutions and formulation of the Study Topics

223. In view of the findings, and the conclusions and recommendations outlined for each, it is sometimes possible to propose solutions. These solutions are presented in the form of hypotheses.

224. **Hypotheses** should be **testable, simple and at the appropriate level** to solve the military problem. Where possible, hypotheses should have applicability beyond the problem and be able to be framed within one of the capability areas. Hypotheses should be **arguable and amenable to validation or refutation**.
225. Depending upon the maturity of the proposed solution, it is sometimes possible to begin drafting study topics. Sometimes this will not be possible until the conceptual development of the solution begins.

226. The study topics are the set of questions to be investigated to solve the problems. Seeking answers to these questions within the scope of the CD&E process focuses the development effort. The study topics serve to guide the investigation of a given project.

227. The proposed solutions (usually a process, an organization or a technology) concerning each study topic shall be tested through experiments to determine how they contribute to the solution of the main problem. For these tests, Essential Elements of Analysis will be developed and supported by metrics, which will be captured during the experiments. These metrics can also be inspired by those used to evidence the problem in the baseline analysis, so that after the experiments it will be possible to make a comparison between the original metrics and those obtained with the new experimented solution, to see to what extent the detected problem or deficiency has been solved.

2.3 REFINEMENT OF THE OPERATIONAL MILITARY PROBLEM

228. After the baseline analysis, there will be a clearer and more focused idea of what the problem is and what the specific gaps that need to be addressed are. This will allow refining the CDD operational military problem statement.

229. It is important at this stage to determine the limit of the problem that can be solved and where the problems of the operational environment that we do not intend to solve begin. Thus, the scope of the solution can be properly delimited.

230. Since the OMP statement is sanctioned by the CHOD in the CDD, any changes to the OMP must be justified.

2.4 KICK-OFF MEETING

231. Once the SME have been officially designated by their originating agencies, the project kick-off meeting will be convened. It will present the OMP, the solution space and the CHOD vision (as contained in the CDD); the project plan and the methodology to be employed and, finally, it will also serve as a presentation of the members of the working group.

3 DELIVERABLES

3.1 LITERATURE REVIEW

232. The findings are stored in a database in the form of bibliographic references so that the information can be easily used and referenced in the future. It is very useful to include a metadata or keyword field for later comparison of documents.

3.2 STATEMENT OF THE OPERATIONAL MILITARY PROBLEM

233. Final version of the statement once refined.
3.3 BASELINE ANALYSIS

234. As a result of the entire bibliographic analysis process, a document called **Baseline Analysis** shall be drafted, containing the background of the problem, the current state of the situation, the findings and questions encountered and a first proposal of study topics to be addressed by the working group in the following phases.

235. The Baseline Analysis report generally has the following sections:

- **Table of contents.** Summary of contents.
- **Background.** Origin of the problem and how it was detected.
- **Methodology.** Criteria for selection and evaluation of the documents.
- **Introduction.** The problem and its relevance to operations.
- **Operational environment.** In which the problem is detected.
- **Current situation.** How the problem is currently being addressed, nationally and internationally (if at all).
- **Results.** Summary of evidence, identified findings and their statistics.
- **Discussion.** Interpretation of the evidence, conceptualization of the findings and analysis of the need for a CD&E campaign.
- **Conclusion.** Summary of relevant issues and proposal of Study Topics.
- **Appendices.** Tables with the analyzed documents, identified findings, study topics, etc.

236. Once the Baseline Analysis (version 1.0) is completed, it should be distributed to the SME in the concept working group for review and comments. The Project Manager shall review the comments and implement those deemed appropriate, resulting in the final version 2.0 of the Baseline Analysis.

4 PHASE END

237. The Discovery and Development phase should not begin until the Baseline Analysis has been published and refined, since the explicit knowledge gathered therein constitutes the starting point for this phase.
CHAPTER 7. DISCOVERY AND DEVELOPMENT

1 OBJECTIVE

238. As noted in the first part of this document, this phase seeks to discover the tacit knowledge that the SME possess but that is not documented and, therefore, has not been reflected in the Baseline Analysis. In those topics for which no answers were obtained in the research phase, it will be necessary to obtain them through the subject matter experts. For this purpose, the necessary discovery experiments shall be organized.

239. Next, we will seek to consolidate both the knowledge resulting from the research phase and that obtained from the SME, as well as to develop the not yet existing knowledge necessary to solve the problem. Through creative techniques, an initial hypothesis about the potential solution can be developed and transformed into a model that allows to better understand it, contrast it with the problem and continue its development in greater detail.

240. This phase will be based on creativity, freedom of thought, participation and collaborative work of all the SME and on the realization of discovery experiments. All this with the intention of reaching the most effective solution to the problem posed.

2 ACTIVITIES

241. In view of the problem, using the guidelines on possible solutions obtained from the Baseline Analysis, a hypothesis on the solution is developed, which must be simple and clear. This initial hypothesis should be developed until the first solution model is designed.

242. The model can be developed by applying different techniques, depending upon the type of problem posed. This model is already an interpretation of the solution in sufficient detail to be reproduced in the experiment but, as in any model, it is important to be aware of the assumptions on which it is based.

243. Once the solution has been modeled, the next step is to develop the study topics, which are those questions that must be answered during development to obtain the solution.

244. Conceptual development begins with the design of processes that bring together the actions needed to solve each gap. This first step requires innovation and imagination, and can be supported by brainstorming techniques. Once these processes have been outlined, it is easy to identify the actors that should be involved, in the form of organizations or units, the relationships that should exist between them and the necessary exchanges of information.

245. Thus, knowing the process, actors and relationships, it is relatively easy to define the structure of the Organization that can face the problem, and once this is defined, it will be necessary to determine what resources this organization needs for its new task: Materiel, Facilities, Personnel, Training, Doctrine and Interoperability.¹⁵

246. Often, the initial knowledge of the problem is so vague and incomplete that it is not possible fully to elaborate these processes, nor to define the information exchange requirements, nor the flow of necessary resources. To advance in the design of the solution, it may be necessary to resort to Discovery Experiments, in which the operational problem is posed, the solution sketched initially is recreated with the presence of the identified actors, and

¹⁵ DOTMLPF-I factors.
these actors are made to interact trying to solve the problem, in search of details not initially detected. This interaction will lead to considerations not initially identified.

2.1 DEMOGRAPHIC SURVEY

247. To assess the experience and the level and origin of knowledge of the SME with respect to the purpose of study of the concept, a demographic survey shall be conducted and all the SME will be asked to respond via the virtual platform.

248. The results of this survey will make it possible to verify that all participants are indeed SME on the subject. Eventually, it could also serve to weight the contributions of each one according to their level of knowledge.

### Competence coefficient of a subject matter expert

The competence coefficient of the SME is determined by conducting a demographic survey, in which the SME self-assesses his or her level of knowledge and experience.

The competition coefficient \( K \) is calculated using the formula:

\[
K = \frac{K_c + K_a}{2}
\]

- \( K_c \) is the degree of knowledge about the subject and is obtained from the answer to the following question:

| How much knowledge do you consider you have on the subject under study? (1 being the lowest grade and 10 being the highest grade) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

- \( K_a \) is the argumentation coefficient, which assesses the sources on which the knowledge acquired by the SME is based. It is calculated as the sum of the following six factors:

\[
k_a = k_1 + k_2 + k_3 + k_4 + k_5 + k_6
\]
2.2 SEMI-STRUCTURED QUESTIONNAIRE

249. This type of questionnaire makes it possible to gather the SME’s knowledge and opinions, in a systematic and objective manner, on different aspects of interest for the development of the concept, with a view to its subsequent analysis.

250. A series of open-ended questions are posed through the virtual platform for the SME to give their opinion in writing on general aspects of the concept and the study topics identified in the research phase.

251. All these responses are analyzed qualitatively and quantitatively to discover undocumented knowledge and to identify those aspects to which SME attach greater importance or on which divergent positions are identified.

252. From the analysis of these questionnaires, new topics of study may emerge that have not been identified so far.

2.3 DISCOVERY EXPERIMENTS

253. This type of experiment seeks to obtain new knowledge, improve the understanding of the problem and advance in the design of its solution based on the implicit knowledge of the SME.

254. The different types of discovery experiments, their main characteristics and associated methodologies can be found in Chapter 4 of this manual.

<table>
<thead>
<tr>
<th>Table 5 - Argumentation $k_x$ coefficient factors.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assess the degree to which each of the following sources supports your knowledge of the topic under study:</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>$k_1$ In theoretical analyses carried out by you</td>
</tr>
<tr>
<td>$k_2$ In the experience gained in your work</td>
</tr>
<tr>
<td>$k_3$ In the research and study of national authors’ works</td>
</tr>
<tr>
<td>$k_4$ In the research and study of foreign authors’ works</td>
</tr>
<tr>
<td>$k_5$ In your own knowledge of the state of the problem abroad</td>
</tr>
<tr>
<td>$k_6$ In your intuition and capacity for abstraction and analysis</td>
</tr>
</tbody>
</table>

As a complement, SME may be asked to cite the activities and documents that make up their experience. This may be useful in discovering previously overlooked bibliographic sources or affected organizations.
2.4 ATTENDANCE AT CONFERENCES AND OTHER EVENTS

255. When preparing the Project Plan, it shall be investigated whether conferences, forums or other types of events concerning the topic will take place during the project period. If so, it may be of interest to attend them to extract undocumented knowledge, learn about the latest trends and even expand the working group with new SME.

256. In this regard, it is considered appropriate to align national conceptual developments with those of similar topics conducted by international organizations and initiatives in which Spain participates (NATO, ACT or the MCDC).

3 DELIVERABLES

3.1 ANALYSIS OF SEMI-STRUCTURED QUESTIONNAIRE

257. Based on the results of the qualitative and quantitative analysis of the responses to the questionnaire, a report shall be drawn up in which the ideas on which there is general consensus and those on which conflicting positions are detected, as well as the new findings, will be noted in a justified manner.

3.2 EXPERIMENT DESIGN DOCUMENT (EDD)

258. Before conducting each discovery experiment, its objectives and the methodologies applied must be clearly defined in a brief document. The aim is to approach these events in a structured and rigorous manner.

3.3 EXPERIMENT REPORT

259. After each discovery experiment, a brief report shall be written, including the results, their analysis, the conclusions drawn and how they affect the concept.

3.4 CONCEPT DRAFTS

260. Successive versions of the document shall be drafted, from 1.0 to 2.0, as it is refined with input from SME.

3.4.1 Concept version 1.0

261. Developed from the Baseline Analysis and the analysis of the semi-structured questionnaire, this very preliminary version serves as a starting point for the working group discussions and discovery experiments.

3.4.2 Concept versions 1.1 to 1.9

262. As the discovery and development phase progresses, drafts of the concept are generated in an iterative process: the results of the discovery experiments and SME comments are included in successive versions that are distributed to the working group for approval.

263. As many drafts as the project manager deems necessary to refine the document will be written and distributed.
3.4.3 Concept version 2.0

264. The end product of the discovery and development phase. This is a complete and refined version of the concept but has not yet been experimentally validated.

4 PHASE END

265. The discovery and development phase will be completed with the publication of the concept draft 2.0. This means that the project manager and the working group consider that the proposed solutions and recommendations have a high degree of maturity and that all necessary implicit knowledge has been extracted.

266. The completion of this phase will be a necessary condition for the validation experiments to be conducted.
CHAPTER 8. VALIDATION

1 OBJECTIVE

267. In this phase, the solution hypotheses proposed in the previous phase are subjected to validation. The validation (or refutation) of these hypotheses is achieved by performing one or more validation experiments.

268. Although in the sequence of the CD&E process this phase appears after the discovery and development phase, it is important to keep in mind that its activities should start as soon as possible and run parallel to the rest of the project activities.

269. The characteristics of this type of experiments are developed extensively in Chapter 4 of this manual.

270. The final result of this phase will be the validation or refutation of the solutions proposed in the concept to the operational military problem posed. If all the proposed hypotheses are validated, the document can move on to the consolidation phase. If, on the other hand, there is a total or partial refutation of the hypotheses, it will be necessary to continue the iterative process of concept development until adequate solutions are found.

2 ACTIVITIES

2.1 DESIGN OF VALIDATION EXPERIMENTS

271. As already mentioned, the design of validation experiments should begin in the earliest stages of concept development. To this end, exercises and other events shall be identified that, coinciding with the concept development process, may be of interest. Moreover, as soon as the first hypotheses for solving the problem are defined, we will begin to analyze which experimentation methodologies are most appropriate to apply.

272. It is important to involve, from the beginning, the concept working group in the design of the experiment to seek their approval, align it with the objectives of the concept and validate the proposed scenarios (if necessary).

273. The design of the experiments will be the responsibility of the Experimentation Manager but should be conducted in close cooperation with the Project Manager. This coordination with the Project Manager and other stakeholders will be materialized by convening at least the following planning meetings:

2.1.1 Initial Planning Conference (IPC)

274. This meeting takes place in the initial stages of concept development and seeks to identify the main and secondary objectives of the experimentation. Moreover, the first proposals on the methodology to be used and on the scenario to be proposed in the experiment are discussed at this meeting.
2.1.2 Main Planning Conference (MPC)

275. The result of this meeting should be an almost definitive design of the experiment, including its objectives, the methodology to be used, the scenario, the participants, the data capture and analysis plan and, in short, all its details.

276. A draft of the EDD is presented at the MPC and shall be revised with the decisions made at the meeting. The final version of the EDD shall be published in the following days.

2.1.3 Final Coordination Conference (FCC)

277. Once the overall test of the experiment is completed, a final meeting of the experiment development team is held to correct the problems detected in the test and to make final adjustments. At this point no major changes should be made to the experiment.

278. This meeting will take place in the days prior to the execution of the experiment.

2.2 DESIGN OF THE DATA COLLECTION AND ANALYSIS PLAN

279. As explained in Chapter 4, a data collection and analysis plan must be developed in parallel to the design of the experiment. This plan defines the metrics that will be used to validate (or refute) the hypotheses proposed and the methods and resources to be used to collect these data. It also specifies the analysis process to be conducted once the experiment has been executed and the impact it will have on the revision of the concept drafts.

280. A draft of the Data Collection and Analysis Plan should be presented at the MPC and will be revised with the decisions made at this meeting.

2.3 PREPARATION OF MATERIALS NEEDED FOR THE EXPERIMENT

281. Depending upon the methodology used, it may be necessary to develop supporting materials for experimentation. The following is a (non-exhaustive) list of possible experimental materials:

- **Scenario mapping**: in printed or digital format. When a fictitious scenario is used, it will be necessary to develop it from scratch or adapt real cartography.
- **Orders of battle**: depending upon the type of experiment, it may be of interest to provide participants with a summary of the orders of battle of the actors present in the scenario. These can be real or fictitious.
- **Concept cards**: they consist of a series of cards, with the same format, in which the fundamental aspects of the concept to be validated in the experiment are summarized schematically and graphically.
- **Data collection sheets**: it may be of interest to prepare, in printed or digital format, pre-formatted data collection sheets to facilitate data collection by the analysts or, where appropriate, by the experiment participants themselves.
- **Questionnaires and surveys** to know the opinion of SME on the study topics or the results of the experiment.
- **Reference documents**: depending upon the type and theme of the experimentation, it may be necessary for participants to have reference documents available.
- **Others**: presentations, spaces on virtual platforms, lists of participants, etc.
282. It is important that the experiment materials are carefully and uniformly formatted as this helps to achieve a good impression in the eyes of the participating SME and, therefore, boost their motivation.

2.4 EXPERIMENT DRY RUN

283. A dry run shall be conducted in the days prior to the execution of the experiment. In this rehearsal, all the phases and materials of the experiment shall be briefly but systematically reviewed.

284. This test will serve to identify last minute problems that, after discussion at the FCC, should be corrected prior to the execution of the experiment.

2.5 EXECUTION OF THE EXPERIMENT

285. The execution of the experiment should be conducted according to the EDD and the Data Collection and Analysis Plan. Any deviation from the original plans must be fully justified and documented.

2.6 ANALYSIS OF THE EXPERIMENT

286. During the execution of the experiment and in the following days, a first analysis is conducted, from which the conclusions that will feed the Preliminary Experimentation Report are drawn.

287. In more detail, an exhaustive analysis will be made of what happened in the experiment and of all the data collected according to the plans elaborated for it. The result of this in-depth analysis shall be included in the Final Experimentation Report (FER).

2.7 REVIEW OF THE CONCEPT DRAFT

288. If the analysis of the experiment concludes that all the hypotheses, main and secondary, have been validated without nuances, it will not be necessary to make any modifications to the concept draft (v2.0) other than those necessary to mention this analysis.

289. If, on the other hand, any of the hypotheses have been refuted or validated with nuances, or if new findings have been identified in the experimentation process, it will be necessary to revise the wording of the concept and prepare new drafts to be circulated to the working group for approval.

290. The final result of this process will be the publication of the concept draft v3.0 that will be sent to the organization for official comments.

3 DELIVERABLES

3.1 EXPERIMENT DESIGN DOCUMENT (EDD)

291. Planning document in which all the details of the design of the experiment are included in detail. It should include the following elements:

- Objectives of the experiment.
- Hypotheses raised in the experiment.
• Execution plans.
• Resource requirements (material and personnel).
• Description of the experimental environment.
• Risk analysis and mitigation plan.
• Support tasks and administrative aspects.

292. A first version of this document (v1.0) should be ready at the time of the MPC. The draft shall be revised according to what was decided at the MPC to solve any problems that may be detected in the dry run. A final version (v2.0) of the EDD should be published before the execution of the experiment.

3.2 DATA COLLECTION AND ANALYSIS PLAN

293. This document sets out the data to be collected, its format, time and mode of capture. It also details how the data collected will be analyzed.

294. Depending upon the entity of the experiment, the Data Collection and Analysis Plan can either be divided into two independent documents or grouped together with the EDD in a single document called the Experimentation Plan.

295. These two plans are vital because implementing them will ensure that reliable and valid data are collected, that the analysis addresses the key issues of the experiment, and that the available data and information are fully understood and exploited and not wasted.

3.3 EXPERIMENTATION PLAN

296. Smaller experiments may group the EDD and the Data Collection and Analysis plans in the same document called Experimentation Plan.

3.4 EXPERIMENT REPORT

297. A document describing the execution of the experiment, its results and the conclusions drawn from their analysis. It must include the following sections:

• Executive summary: brief summary of the document and its main conclusions.
• Introduction.
• Experimental hypotheses raised. They can be divided into subordinate hypotheses.
• Background: it must include a description of the methodology used.
• Execution: detailed and objective review of what happened during the execution phase of the experiment.
• Analysis of the data collected according to the Data Collection and Analysis Plan.
• Conclusions of the experiment. Including the validation or refutation of each hypothesis.
• Other findings: those findings made during the experiment and not foreseen in the Data Collection and Analysis Plan.
• Attachments with the raw data captured.
298. To speed up the review process of the concept drafts, a preliminary version of the experiment report will be published as soon as possible. This brief document will contain the main conclusions and findings of the experiment without going into details on the execution of the experiment or its analysis.

3.5 CONCEPT DRAFTS

299. Successive versions of the document will be written, from 2.1 to 3.0, as it is refined with the results and conclusions of the validation experiments performed.

3.5.1 Concept versions 2.1 to 2.9

300. As the different validation experiments are conducted (if more than one is performed), an iterative process is initiated in which the conclusions and findings of these experiments are transferred to successive versions that are distributed to the working group for review.

301. As many drafts of the concept will be written and distributed as the Project Manager deems necessary to refine the document.

3.5.2 Concept version 3.0

302. The end product of the validation phase, this is a complete and refined version of the concept that has been validated experimentally. This version of the document is the one distributed to the organization for official comments.

4 PHASE END

303. The validation phase may be completed with the publication of the concept draft 3.0 and the final experimentation report.
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CHAPTER 9. CONSOLIDATION

1 OBJECTIVE

304. The purpose of this phase is to feed back the concept draft with official comments from the different authorities of the organization, to verify that it does not conflict with other conceptual or doctrinal developments and maintains interoperability with existing capabilities. The developed solution is analyzed to ensure that it is practicable and acceptable.

305. Once the consolidation has been completed, the CCDC shall submit the concept to the CHOD for promulgation and subsequent implementation.

2 ACTIVITIES

2.1 COLLECTION AND CONSOLIDATION OF FEEDBACK FROM THE ORGANIZATION

306. The concept draft (v3.0), already fed back with the results of the validation phase, is distributed to the entire organization to collect official comments on the document.

307. These comments, prioritized by importance, are analyzed individually and implemented or rejected based on their fit with the conclusions of the concept and with the rest of the organization’s comments.

308. To gather official comments, a table is distributed in which the following fields must be completed by the different agencies:

- **Paragraph**: number of the paragraph to which the comment applies.
- **Proposed action**: delete paragraph, modify text, add, etc.
- **Proposed new wording**.
- **Justification**: reasons for the proposed change and documentary references if any.
- **Importance of changes**:
  - **Minor**: writing, spelling, etc.
  - **Important**: it affects the content.
  - **Fundamental**: it affects the concept and is a reason for opposition to its approval.

| Consolidation Phase Comments Table |

309. Experience shows that this consolidation process can take time when one of the agencies has major objections to the concept. For this reason, it is essential that the agencies, through their representatives on the Concept Committee (COECON), have visibility over the entire development of the concept to avoid misunderstandings and speed up this consolidation phase.

2.2 PROJECT CLOSING ACTIVITIES

310. Once the concept has been approved, a number of tasks must be conducted before the project can be closed:
• **Compilation of documents**: all project deliverables should be grouped, in an orderly fashion, in a folder. This makes it easier for outsiders to approach the project in the future.

• **Folder cleaning**: before closing the project, the project folders should be cleaned and tidied up by deleting temporary working documents. It is intended that a person outside the project can easily navigate through the folder structure if necessary.

• **Closure of the project plan**: knowing the deviations, in the different phases, with respect to the original plan will allow better planning of future projects.

• **Lessons learned**: it is important to keep a documentary record of the findings and lessons learned in each project.

### 2.3 DISSEMINATION OF THE CONCEPT

311. Dissemination, both inside and outside the organization, of the work done is essential for it to achieve the desired effects. To this end, a series of activities can be carried out:

• **Dissemination**: Once approved, the document should be circulated to all affected agencies and units. Moreover, it should be made available to the public (depending upon its classification level) on the CCDC’s intranet and internet portals.

• **Booklet edition**: It is considered useful to edit the concept (without appendices) in booklet format to facilitate its dissemination in forums and meetings attended by the CCDC. To this end, a cover page should be designed for the concept following the usual format.

• **Translation**: When international dissemination of the document is considered to be of interest, a translation into English (or other languages) will be required.

• **Presentations**: It may be of interest to make presentations of the concept to the main organizations concerned and at events and forums of interest.

### 3 DELIVERABLES

#### 3.1 CONCEPT DRAFTS

##### 3.1.1 Concept versions 3.1 to 3.9

312. As many drafts as necessary shall be published at this stage to allow for official comments to be accepted. Each of these drafts will be circulated again to all agencies.

#### 3.2 FINAL VERSION OF THE CONCEPT

313. The final result of the consolidation phase is the final version of the concept (v4.0). This version shall be submitted to the CHOD for promulgation and will be used to guide the concept Implementation Plan.

314. It is especially important that the format of this version of the document respects the CCDC style standards, since once it has been approved it should not undergo any further modifications.
4 PHASE END

315. The consolidation phase and, in general, the conceptual development project ends once the concept is sanctioned by the CHOD.

316. Even if the project is closed at this point, the CCDC must be able to resolve any doubts raised by those in charge of the Implementation Plan, as well as to follow up on the implementation process.
CHAPTER 10. SOLUTION IMPLEMENTATION

1 INTRODUCTION

317. The CD&E process contributes to force development by identifying solutions that will potentially solve the operational military problems detected and, by assessing and validating these ideas and solutions. Finally, the solutions should improve military capabilities through their integration in the domains of Materiel, Facilities, Personnel, Training, Doctrine and Organization; and also, be Interoperable.

318. This integration will obviously require a prior analysis in the form of a document containing recommendations for the transition or implementation of the solution, followed by an action plan setting out guidelines, responsible authorities and timetables. Solutions may be material or non-material:

- **Material solutions** involve the acquisition of some equipment or the incorporation of new technology, facilities and personnel. The CD&E process must be able to guide the material requirements needed to be transferred to the Force Planning process.

- **Non-material solutions** take the form of recommendations for changes to doctrine, organization, training or education. These types of solutions are often an essential part of force development, allowing as they do new ideas and existing capabilities to be exploited in an ever-constraining financial environment and increasing bottom-line efficiency.

319. To implement the solution, it is necessary to designate the responsible authority. The Plans Division (DIVPLA) of the Joint Staff (EMACON) is responsible for drafting and executing the Implementation Plan in collaboration with the rest of the community of interest.

320. Implementation plans shall only be prepared for operational and basic concepts, but not for exploratory concepts. In any case, this task is not the responsibility of the CCDC.

2 IMPLEMENTATION RECOMMENDATIONS

321. A recommendation is a reasoned proposal for action relevant to the organization’s use of a solution, in whole or in part. Recommendations are usually made by areas of the DOTMLPF-I factors.

2.1 MATERIEL

322. It is the recommendation to solve a deficiency through the incorporation of a new technology that results in the development or acquisition and commissioning of new equipment, as well as those military support activities necessary for its maintenance.

2.2 FACILITIES

323. Those recommendations aimed at filling gaps in the area of infrastructure, whether military or industrial, that support and service the capability to be developed.
2.3 PERSONNEL

324. Sometimes, the solution to an operational military problem requires assigning personnel to the capability in question. This can be achieved by expanding personnel levels (highly unlikely given existing constraints) or by reallocating human resources or increasing the tasks assigned to them.

2.4 TRAINING

325. Training is the set of activities aimed at providing the necessary skills for effective use of a capability; it includes such things as teaching, technical training and individual and collective operational training.

326. Training in the new solution is one of the most powerful ways to implement it. To this end, the products to be used in training, especially doctrinal or pre-doctrinal documents, must be developed beforehand.

327. The key players in this process are ESFAS and the Army, Navy and Air Force training agencies.

2.5 DOCTRINE

328. Concepts and doctrine shape the way the force operates, but, while doctrine provides authoritative guidance, concepts shape the force by providing guidelines for its future development, which will ultimately translate into the capabilities needed to execute doctrine.

329. The need to develop or adapt joint doctrine or to include or modify terms in the terminology used jointly is frequently raised among the recommendations of the concepts.

330. However, not all doctrinal changes are derived from one concept, as the doctrine review process is dynamic and incremental, so doctrine evolves naturally as it is used in operations and exercises.

2.6 ORGANIZATION

331. Every solution requires an implementation in the organization. This implementation may be simply the order to use the solution, or it may require organizational changes, such as changing the dependency of an entity, changing functional relationships or even creating new units.

2.7 INTEROPERABILITY

332. This last factor responds to the capability to operate interconnected or integrated with other capabilities, organizations and agencies.

3 CONCEPT IMPLEMENTATION PLAN

333. Following the proposals contained in the recommendations, the designated authority shall draft an Implementation Plan, which will develop the activities necessary to transition the solution to the organization, detail the responsibilities of the subordinate authorities, the
implementation deadlines and the indicators that will show that the solution has been delivered to the organization.
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Centro Conjunto de Desarrollo de Conceptos (CCDC)
Concept Development Joint Center

Force Development Division (DIVDEF)
Joint Staff (EMACON)
C/ Vitruvio 1, Madrid