DRDC Toronto No. CR2006-076

DEVELOPMENT AND EVALUATION OF AN INTUITIVE OPERATIONS PLANNING PROCESS

ÉLABORATION ET ÉVALUATION D'UN PROCESSUS DE PLANIFICATION INTUITIVE DES OPÉRATIONS

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Abstract

This work represents the fourth phase of a project investigating the Canadian Forces (CF) Operational Planning Process (OPP) and an alternative planning process based on intuitive decision making. This is in support of a larger project, Project Minerva, focused on re-examining Command and Control (C2), specifically the CF OPP, in the Land Force in light of the implementation of digitized C2 systems. The CF OPP represents an analytic decision making process in which 1) multiple solutions to the problem must be evaluated and the best selected, and 2) evaluation of solution alternatives must be performed through exhaustive factor-by-factor comparison. Research in the cognitive sciences has suggested that a large portion of human decision making is conducted intuitively; i.e. by less formal, non-analytic processes. Thus, there may be a mismatch between the OPP as laid out in doctrine and taught at training and education institutions within the CF, and the planning process as practiced by command teams in more operational settings, especially at the Brigade level and below.

Specifically, the current work includes the development of an alternative planning process based on intuitive decision making (referred to as the Intuitive Operations Planning Process or IOPP), the development of a training course for the IOPP, and an evaluation of the effectiveness of the IOPP compared to the existing CF OPP.

The IOPP exhibits the best characteristics of other intuitive planning models (Kievenaar, 1997; Schmitt & Klein, 1999; Thunholm, 2005; Whitehurst, 2002) and incorporates findings from previous work investigating application of the OPP in the CF (Bruyn et al., 2005), while maintaining a large amount of the terminology, outputs generated and formal staff briefings used in the OPP in order to promote level of acceptance by CF practitioners and face validity of the IOPP.

A web-based training course for both the OPP and IOPP was developed as it allows more flexibility in terms of the delivery of the training than lecture-based training. Aside from some minor technological complications, delivery of the training courses proved to be successful. Participants provided valuable feedback in terms of training content and delivery that should be taken into account in future training enhancements

The first iteration of the IOPP model resulted in positive feedback from participants in the experimental evaluation. It was also found that the IOPP outperformed the OPP in terms of efficiency, number of steps performed, quality of planning products, usability of planning process, operational effectiveness, and participant workload levels. On the other hand, participants' perceived level of trust and reliability was lower for the IOPP compared to the OPP. They also felt that the IOPP was more likely to lead to errors (and more critical errors) in a Plan. Participants also provided a number of benefits and limitations of the IOPP, which should be considered in future research.

Résume

Ce travail est la quatrième phase d'un projet d'enquête sur le processus de planification opérationnelle (PPO) des Forces canadiennes (FC) et un processus de planification de rechange fondé sur la prise de décisions intuitives. Il vise à appuyer un projet plus vaste, le projet Minerve, qui est axé sur un nouvel examen du commandement et contrôle (C2) en particulier le PPO FC dans la force terrestre, compte tenu de la mise en place des systèmes C2 numérisés. Le PPO FC représente un processus de prise de décision analytique au cours duquel 1) plusieurs solutions au problème doivent être évaluées et la meilleure solution choisie et 2) l'évaluation de solutions de rechange doit être effectuée par une comparaison exhaustive critère par critère. Les recherches en sciences cognitives indiquent qu'une grande partie de la prise de décision humaine est intuitive, c'est-à-dire qu'elle s'effectue selon un processus moins analytique, moins formel. Par conséquent, il peut y avoir une discordance entre le PPO tel que décrit dans la doctrine et enseigné dans les établissements d'éducation et d'instruction des FC et le processus de planification tel que mis en pratique par l'équipe de commandement dans les contextes plus opérationnels, en particulier à la brigade et aux niveaux inférieurs.

Plus particulièrement, ce travail comprend l'élaboration d'un processus de planification de rechange fondé sur la prise de décisions intuitives (appelé Processus de planification intuitive des opérations ou PPIO), la préparation d'un cours sur le PPIO et une évaluation de l'efficacité du PPIO par rapport au PPO FC actuel.

Le PPIO présente les meilleures caractéristiques d'autres modèles de planification intuitive (Kievenaar, 1997; Schmitt & Klein, 1999; Thunholm, 2005; Whitehurst, 2002) et inclut des résultats de travaux de recherche précédents portant sur la mise en œuvre du PPO dans les FC (Bruyn et coll., 2005), tout en conservant une grande partie de la terminologie du PPO, les commentaires générés par le PPO et des séances d'information officielles employées dans le cadre de ce processus afin de favoriser le degré d'acceptation des utilisateurs des FC et la validité apparente du PPIO.

Un cours en ligne sur le PPO et le PPIO a été préparé car il permet une plus grande souplesse concernant la prestation de l'instruction qu'un cours en salle de classe. Outre quelques complications technologiques, la prestation de l'instruction s'est avérée un succès. Les participants ont fait des commentaires utiles sur le contenu de l'instruction et la prestation dont il faudrait tenir compte lors des prochaines révisions de l'instruction

La première itération du modèle PPIO a suscité des commentaires positifs de la part des participants au cours de l'évaluation expérimentale. On a aussi constaté que le PPIO est supérieur au PPO en ce qui a trait à l'efficacité, au nombre d'étapes nécessaires, à la qualité des produits de planification, à la convivialité du processus de planification, à l'efficacité opérationnelle et à la charge de travail des participants. D'autre part, les participants ont trouvé que le niveau de confiance et de fiabilité du PPIO était inférieur à celui du PPO. Ils ont aussi eu l'impression que le PPIO risquait davantage de donner lieu à des erreurs (et des erreurs plus critiques) dans un plan. Les participants ont aussi donné les avantages et les limites du PPIO dont il faudra tenir compte lors des prochaines recherches.

Executive Summary

This work represents the fourth phase of a project investigating the Canadian Forces (CF) Operational Planning Process (OPP) and an alternative planning process based on intuitive decision making. This is in support of a larger project, Project Minerva, focused on re-examining Command and Control (C2), specifically the CF OPP, in the Land Force in light of the implementation of digitized C2 systems. The CF OPP represents an analytic decision making process in which 1) multiple solutions to the problem must be evaluated and the best selected, and 2) evaluation of solution alternatives must be performed through exhaustive factor-by-factor comparison. Research in the cognitive sciences has suggested that a large portion of human decision making is conducted intuitively; i.e. by less formal, non-analytic processes. Thus, there may be a mismatch between the OPP as laid out in doctrine and taught at training and education institutions within the CF, and the planning process as practiced by command teams in more operational settings, especially at the Brigade level and below.

Specifically, the current work includes the development of an alternative planning process based on intuitive decision making (referred to as the Intuitive Operations Planning Process or IOPP), the development of a training course for the IOPP, and an evaluation of the effectiveness of the IOPP compared to the existing CF OPP.

The first iteration of the IOPP model exhibits the 'best' characteristics of other intuitive planning models (Kievenaar, 1997; Schmitt & Klein, 1999; Thunholm, 2005; Whitehurst, 2002) and incorporates findings from previous work investigating application of the OPP in the CF (Bruyn et al., 2005), while maintaining much of the terminology, outputs generated and formal staff briefings used in the OPP in order to promote level of acceptance by CF practitioners and face validity of the IOPP. The key characteristics of the IOPP are as follows:

- The development of only 1 COA at a time;
- Mental wargaming as opposed to traditional wargaming;
- Continuous situational awareness throughout the process;
- Feedback loops from COA development, COA validation and Plan Development to the beginning of Mission Analysis;
- The concurrent performance of Mission Analysis and COA Development;
- The continuous reciprocal input and feedback from Situation Awareness (SA) to every other high level function in the IOPP, and,
- Early and frequent communication with lower formations.

A web-based training course for both the OPP and IOPP was developed as it allows more flexibility in terms of the delivery of the training than lecture-based training. Aside from some minor technological complications, delivery of the training courses was successful and overall participants provided positive feedback on the content and format of both the OPP and IOPP training. Participants did suggest, however, that the web-based training should be supplemented by a form of face-to-face training such as lecture-based or syndicate group work. As well, participants were dissatisfied with the lack of opportunity to ask questions at any time during the training. This could be addressed by incorporating some form of face-to-face interaction into the training. Participant feedback on the training also suggests that incorporating more concrete

examples of how to apply the IOPP and what products should be generated, would have made the training more effective.

The experimental evaluation represented the first application of the IOPP in an operational context. In general, results suggest that teams were able to follow the IOPP without much difficulty, although some participants were somewhat reluctant to commit to a single COA. The experimental evaluation also showed that the IOPP outperformed OPP in terms of efficiency, number of steps performed, quality of planning products, usability of planning process, operational effectiveness (suitability in a variety of operational contexts), and participant workload levels (i.e. IOPP leads to lower workload). It was also observed that application of the IOPP resulted in more looping and repeated steps compared to the OPP. This was anticipated given that the IOPP was designed to be iterative and also prescribes the way in which iterations should occur. On the other hand, participants' perceived level of trust and reliability was lower for the IOPP compared to the OPP. They also felt that the IOPP was more likely to lead to errors (and more critical errors) in a Plan.

In terms of participant feedback on the IOPP, teams noted a number of benefits of the IOPP including efficiency, flexibility, increased collaboration, earlier identification of COA, more detailed analysis of COA, earlier and more frequent communication with lower formations, and the opportunity to take advantage of the experience of the Commander. Teams also noted some potential limitations of the IOPP including the risk of committing to a bad COA too soon, reliance on experience and strength (in terms of personality) of the Commander, fewer "benchmarks" on the way to the Plan, suitability in an asymmetric environment, and the tendency to get off track because of focus on situational awareness.

Limitations of the study, including the participants' lack of experience with the IOPP, the level of realism of the experiment, the presence of a learning effect, and challenges associated with observer data collection are addressed and recommendations are made for future studies.

Recommendations for future work are presented with respect to the IOPP model, training of the IOPP and future experimental evaluation. In terms of the IOPP model, further development of the model should be pursued. Publication and communication of the IOPP to a broader audience is essential to successful development of further iterations of the IOPP. In communicating the IOPP to a broader audience, the fact that the IOPP incorporates the best aspects of existing intuitive models and incorporates continuous SA check and iterative mission analysis and COA development, should be emphasized. Future research should specifically address criteria for success and SA in general in terms of how these concepts should best be implemented and represented in the planning process.

Several opportunities exist for training enhancements including the development of the SA component of training, improved online capabilities of the training, the provision of 24/7 support, online conferencing with audio and visual capabilities, the use of virtual syndicates, and the use of more concrete examples.

Future experimental evaluations should comprise at least a 3-day exercise in order to circumvent first day familiarization. Also, the involvement of more planning teams would be desirable in order to create a totally balanced experiment. The involvement of more participants would also increase the validity and generalizability of results. A more representative training environment may also enhance the realism of the experience. In addition, more dynamic scenarios that better

represents modern warfare, such as asymmetric warfare, would be desirable. Further, scenarios should be different enough that there is no learning effect between the scenarios. That is, planning teams should have to do an equivalent amount of mission planning for both scenarios. Teams would also likely benefit from more detailed examples of expected output (e.g. battle matrix).

Sommaire

Ce travail est la quatrième phase d'un projet d'enquête sur le processus de planification opérationnelle (PPO) des Forces canadiennes (FC) et un processus de planification de rechange fondé sur la prise de décisions intuitives. Il vise à appuyer un projet plus vaste, le projet Minerve, qui est axé sur un nouvel examen du commandement et contrôle (C2) en particulier le PPO FC dans la force terrestre, compte tenu de la mise en place des systèmes C2 numérisés. Le PPO FC représente un processus de prise de décision analytique au cours duquel 1) plusieurs solutions au problème doivent être évaluées et la meilleure solution choisie et 2) l'évaluation de solutions de rechange doit être effectuée par une comparaison exhaustive critère par critère. Les recherches en sciences cognitives indiquent qu'une grande partie de la prise de décision humaine est intuitive, c'est-à-dire qu'elle s'effectue selon un processus moins analytique, moins formel. Par conséquent, il peut y avoir une discordance entre le PPO tel que décrit dans la doctrine et enseigné dans les établissements d'éducation et d'instruction des FC et le processus de planification tel que mis en pratique par l'équipe de commandement dans les contextes plus opérationnels, en particulier à la brigade et aux niveaux inférieurs.

Plus particulièrement, ce travail comprend l'élaboration d'un processus de planification de rechange fondé sur la prise de décisions intuitives (appelé Processus de planification intuitive des opérations ou PPIO), la préparation d'un cours sur le PPIO et une évaluation de l'efficacité du PPIO par rapport au PPO FC actuel.

La première itération du PPIO présente les meilleures caractéristiques d'autres modèles de planification intuitive (Kievenaar, 1997; Schmitt & Klein, 1999; Thunholm, 2005; Whitehurst, 2002) et inclut des résultats de travaux de recherche précédents portant sur la mise en œuvre du PPO dans les FC (Bruyn et coll., 2005), tout en conservant une grande partie de la terminologie du PPO, les commentaires générés par le PPO et des séances d'information officielles employées dans le cadre de ce processus afin de favoriser le degré d'acceptation des utilisateurs des FC et la validité apparente du PPIO. Les principales caractéristiques du PPIO sont les suivantes :

- L'élaboration d'un seul plan d'action à la fois;
- Utilisation de jeux de guerre mentaux au lieu des jeux de guerre traditionnels;
- Connaissance continue de la situation tout au long du processus;
- Boucles de rétroaction sur l'élaboration et la validation de plan d'action, et préparation du plan dès le début de l'analyse de la mission;
- Analyse de la mission et élaboration du plan d'action exécutées simultanément;
- Commentaires continus et réciproques de la connaissance de la situation (CS) à toutes les autres fonctions de niveau supérieur du PPIO;
- Communications fréquentes dès le début du processus avec les formations de niveau inférieur.

Un cours en ligne sur le PPO et le PPIO a été préparé car il permet une plus grande souplesse concernant la prestation de l'instruction qu'un cours en salle de classe. Outre quelques complications technologiques, la prestation de l'instruction s'est avérée un succès. L'ensemble des participants ont fait des commentaires positifs sur le contenu et le format de l'instruction sur

le PPO et le PPIO. Les participants ont cependant proposé de remplacer l'instruction en ligne par une instruction traditionnelle comme des exposés ou des travaux d'équipe en atelier. Les participants se sont aussi montrés insatisfaits du peu d'occasion de poser des questions à tout moment au cours de l'instruction. Cette situation peut être corrigée en ajoutant des interactions en face-à-face. Les commentaires des participants sur l'instruction laissent aussi penser que l'ajout d'exemples plus concrets pour démontrer comment appliquer le PPIO et les produits attendus aurait permis d'améliorer l'efficacité de l'instruction.

L'évaluation expérimentale constitue la première application du PPIO dans un contexte opérationnel. De manière générale, les résultats laissent penser que les équipes ont été en mesure de suivre le PPIO sans trop de difficulté, même si certains participants semblaient hésitants à soumettre un seul plan d'action. L'évaluation expérimentale a également démontré que le PPIO était supérieur au PPO en ce qui a trait à l'efficacité, au nombre d'étapes nécessaires, à la qualité des produits de planification, à la convivialité du processus de planification, à l'efficacité opérationnelle (pertinence dans une variété de contextes opérationnels) et à la charge de travail des participants (c.-à-d. que le PPIO entraîne une diminution de la charge de travail). On a aussi observé que l'application du PPIO donnait lieu à davantage de boucles et de répétitions d'étapes par rapport au PPO. On avait prévu la situation étant donné que le PPIO a été conçu pour être itératif et pour déterminer de quelle façon les itérations devraient se produire. D'autre part, les participants ont trouvé que le niveau de confiance et de fiabilité du PPIO était inférieur à celui du PPO. Ils ont aussi eu l'impression que le PPIO risquait davantage de donner lieu à des erreurs (et des erreurs plus critiques) dans un plan.

En ce qui a trait aux commentaires des participants, les équipes ont fait remarquer que le PPIO comportait un certain nombre d'avantages, notamment l'efficacité, la souplesse, une collaboration accrue, la détermination hâtive d'un plan d'action, une analyse plus détaillée du plan d'action, des communications fréquentes et plus rapides avec les formations de niveau inférieur et l'occasion de tirer parti de l'expérience du commandant. Les équipes ont aussi remarqué que le PPIO présentait des limites potentielles, notamment le risque de soumettre un mauvais plan d'action trop hâtivement, la confiance accordée à l'expérience et aux forces (en parlant de la personnalité) du commandant, des repères moins nombreux entourant la préparation du plan, la pertinence d'un environnement asymétrique et la tendance à se désorienter en raison de l'importance accordée à la connaissance de la situation.

La question entourant les limites de l'étude est actuellement examinée, notamment le manque d'expérience des participants avec le PPIO, le degré de réalisme de l'expérience, la présence d'un effet d'apprentissage et les défis associés à la collecte de données par l'observateur et des recommandations sont faites pour les études subséquentes.

Des recommandations sur les travaux à venir concernant le modèle PPIO, l'instruction sur le PPIO et la prochaine évaluation expérimentale sont présentées. En ce qui concerne le modèle PPIO, il faut continuer à le développer. La publication et la transmission du PPIO à un plus grand nombre de personnes est essentiel pour réussir à préparer d'autres itérations du PPIO. En communiquant le PPIO à un plus grand nombre de personnes, il faudrait insister sur le fait qu'il comprend les meilleurs aspects des modèles intuitifs existants et inclut une vérification continue de la CS, une analyse itérative de mission et la préparation d'un plan d'action. Les prochaines recherches devraient s'attarder plus particulièrement aux critères de succès et à la CS en général

en ce qui concerne la meilleure façon de mettre en œuvre ces concepts et de les présenter dans le processus de planification.

Il existe plusieurs possibilités pour améliorer l'instruction, notamment préparer l'instruction sur la CS, améliorer les capacités de l'instruction en ligne, fournir un soutien 24 heures par jour, 7 jours par semaine, tenir des conférences en ligne avec image et son, utiliser des ateliers virtuels et utiliser des exemples plus concrets.

Les prochaines évaluations expérimentales devraient inclure au moins un exercice de trois jours afin d'éviter la première journée de familiarisation. De plus, il serait souhaitable qu'un plus grand nombre d'équipes de planification participent afin de créer une expérience totalement équilibrée. La participation d'un plus grand nombre de personnes augmenterait aussi la validité et la généralisabilité des résultats. Un environnement d'instruction plus représentatif permettrait aussi de favoriser le réalisme de l'expérience. En outre, il serait indiqué de disposer de scénarios plus dynamiques et plus représentatifs de la guerre moderne, comme la guerre asymétrique par exemple. Les scénarios devraient également être assez différents pour éviter l'effet d'apprentissage entre les scénarios. C'est-à-dire que les équipes de planification devraient faire autant de travail de planification de mission pour les deux scénarios. Les équipes tireraient probablement davantage profit d'exemples plus détaillés des résultats attendus (p. ex. matrice de combat).

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1. Introduction

1.1 Background

The intention of Project Minerva is to re-examine Land Force Command and Control (C2) in light of the implementation of digitized C2 systems within the context of the Athene Tactical System. The Land Force wishes to develop procedures that capitalize on the strengths of digitization. Defence Research and Development Canada (DRDC) Toronto is supporting Project Minerva by carrying out studies into human decision making, planning and the Operations Planning Process (OPP).

Project Minerva focuses on the OPP, which is the prescribed method of planning for a mission. Although the OPP was developed without any explicit relation to psychological theories of problem solving and decision making, it is consistent with analytic decision making (Bryant, Webb, & McCann, 2003). In particular, the OPP conforms to two major premises of analytic decision making; 1) multiple solutions to the problem must be evaluated and the best selected, and 2) evaluation of solution alternatives must be performed through exhaustive factor-by-factor comparison.

Research in the cognitive sciences has suggested that a large portion of human decision making is conducted intuitively; i.e. by less formal, non-analytic processes. Thus, there may be a mismatch between the OPP as laid out in doctrine and taught at training and education institutions within the Canadian Forces (CF), and the planning process as practiced by command teams in the field. In particular, command teams at Brigade level and below may engage in a more intuitive process than the doctrinal OPP. An intuitive planning process may be preferable to an analytic process as intuitive reasoning has been demonstrated to require less information and consume less time than strictly analytic processes. Even where analytic processes have advantages, innate tendencies of humans to think intuitively may reduce the effectiveness of an analytic procedure such as the OPP when put into practice. These arguments for intuitive procedures, however, may not apply when decision making is considered in the context of highly complex, dynamic problem scenarios involving many different planning participants.

The current work represents the fourth phase of this project and includes the development of an alternative planning process based on intuitive decision making and an evaluation of the effectiveness of the intuitive-based planning process compared to the existing OPP. The following section briefly describes work performed in the first three phases of the project.

The project has been contracted to Human*systems* Incorporated® (Human*systems*®, HSI®) for DRDC Toronto under contract W7711-0047907/001/TOR. The Scientific Authority for this work is Dr. David Bryant.

1.2 Previous Work

Three studies have been conducted by DRDC Toronto under Project Minerva: a function flow analysis of the CF OPP as described in doctrine (Bruyn et al, 2004); a literature survey for papers concerning intuitive decision making and planning (Lamoureux, 2004); and a function

flow analysis and comparison of the CF OPP in practice with the CF OPP in doctrine (Bruyn et al, 2005).

The first study (Bruyn et al, 2004) determined that the CF OPP was slightly different to the OPP practiced by the Land Force in that it had five steps instead of six. The CFOPP is the operational level planning process outlined in Joint Doctrine (National Defence, 2002) and is the planning process taught at the Canadian Forces College (CFC) in Toronto. The OPP, on the other hand, exists in the Land Force Command doctrine (National Defence, 1996) and is the planning process taught at Canadian Land Force Command and Staff College (CLFCSC) in Kingston.

Figure 1 shows the six step process followed by the Land Force. Observations were also made regarding the employment of the OPP by Brigade-level Staffs and below. The OPP was described in relation to the different levels of command and the other approaches to planning (notably the Estimate). Finally, all the steps in the OPP were described in terms of their triggers, their outputs, their information requirements, and the Staff responsible for them.

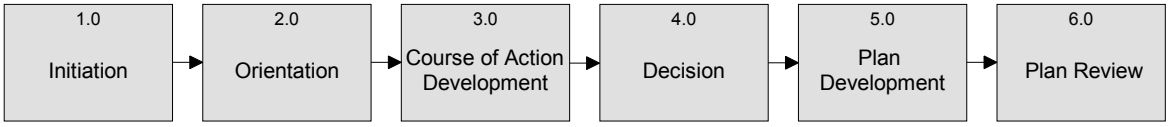

Figure 1: Six step planning process used by the Land Force

The second study (Lamoureux, 2004) surveyed the available literature regarding decision making and planning, paying particular attention to literature that specifically addressed intuitive decision making and planning. Although this work was not a literature review per se (it sought only to identify and obtain the most relevant literature and draw some high level conclusions from the abstracts), the conclusions drawn provide a preliminary appreciation of the differences between intuitive and analytic approaches to planning.

The third study (Bruyn et al, 2005) involved the observation of a Brigade planning Staff during Exercise VIRTUAL RAM at Canadian Forces Base (CFB) Edmonton. This observation was conducted with 1 Canadian Mechanized Brigade Group (1 CMBG) in realistic field conditions in January 2005. Several conclusions from this study are particularly noteworthy in the context of the current contract. First, it was apparent that the role of the Commander (Comd) in the application of the OPP was extremely significant. During this study, the Commander conducted several steps of the OPP himself, provided detailed guidance regarding how to apply the OPP, and also provided, during one planning cycle, the specific COA to be developed. This approach to planning by the Commander can be considered intuitive, based on his experience and training. A second observation was that, independent of the Commander's guidance, the planning Staff only engaged in some of the OPP steps, skipping over many that may or may not have been relevant. Related to this, it was apparent that the Staff were 'looping' back and forth between different steps in the OPP, rather than following the OPP sequentially. Figure 2 shows the type of 'looping' seen between steps of the OPP (steps are in alphabetical order). This implies an iterative process of COA and Plan Development, from which one can deduce that planning behaviour is more opportunistic in terms of the factors considered, which is closer in approach to intuitive decision making than analytic. Finally, it was felt that the planning Staff did not have sufficient time or resources to conscientiously apply the OPP as prescribed in doctrine. While at

a high level (i.e. the highest level functions such as 1.0 Initiation, 2.0 Orientation) the Bde Staff, in general, followed the sequence of the OPP, at a low level (i.e. low level functions such as 'Assess suitability of each COA') they were observed to abbreviate steps, move backward and forward between steps, and to not always engage in the exhaustive factor-by-factor consideration of options. This suggests the use of intuitive strategies by individuals in the Plans Cell.

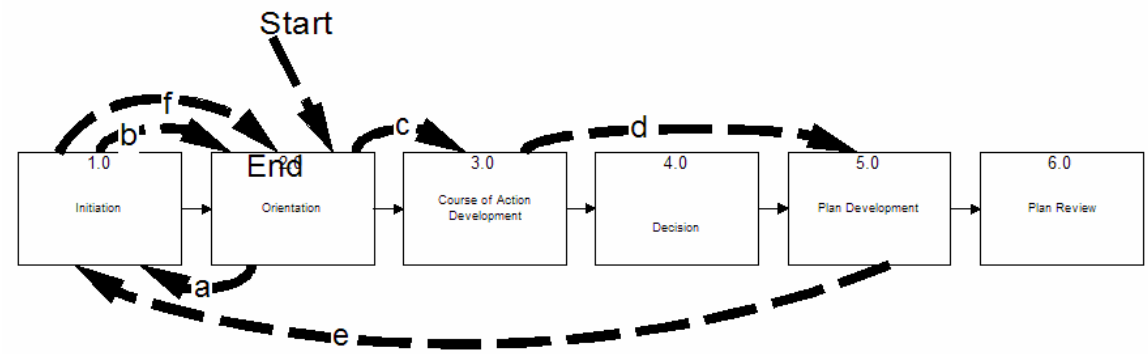

Figure 2: Example of function flow, showing actual flow between doctrinal functions

Bruyn et al. (2005) made several recommendations for follow-on work, including the development of intuitive models of planning, the creation of a training syllabus, and the comparative evaluation of analytic and intuitive planning approaches at the operational level.

1.3 Current Work

The overall objective of this phase of the project was to develop an intuitive planning process (referred to as the Intuitive Operations Planning Process, or IOPP), create a training program to teach the planning process, and evaluate the effectiveness of a planning process based on intuitive planning and decision making relative to the existing OPP, which is consistent with what has been termed analytic decision making (Bryant, Webb, and McCann, 2003). To compare the effectiveness of the IOPP and OPP an experiment was performed to assess the effectiveness and efficiency of each process in a simulated battle group level exercise.

The following work tasks were performed for this project (task numbers correspond to tasks as outlined in the Statement of Work (SOW):

- Task #1: Project Management
- Task #2: Develop and Document Intuitive/Abbreviated Planning Process
- Task #3: Develop Training Course for Battalion/Brigade Staffs
- Task #4: Design and Conduct Experimental Evaluation of Intuitive Planning Process
- Task #5: Prepare and Submit Final Report

This document represents the final report for the project and therefore includes a comprehensive description of Tasks 2-4.

2. Development and Documentation of Intuitive Planning Process

2.1 Method

2.1.1 Review of existing planning models

The development of an alternative planning process based on intuitive decision making and planning began with a review of existing or other proposed military intuitive planning models. The models reviewed included The Recognition Planning Model (Schmitt & Klein, 1999), The Planning Under Time Pressure (PUT) model (Thunholm, 2005), the Accelerated Decision-Making Model (Kievennar, 1997), and the Abbreviated Military Planning Process (AMPP) (Whitehurst, 2002). In reviewing the models, characteristics of the models were compared and contrasted. Table 1 shows the comparison of advantages and disadvantages of the various intuitive planning models reviewed. From this, we created a "wish list" that included the "best" elements from each model. No strict definition of "best" was used during this work. Rather, it was assumed that what was observed during the third study represented the manner in which individuals would choose to plan. Thus, the "best" elements of the various intuitive planning models were those that were common to two or more models and those that reflected activities and behaviours previously observed in planning Staffs in operational settings (Bruyn et al., 2005).

Table 1: Advantages and disadvantages of intuitive planning models reviewed

Model Reviewed	Advantages	Disadvantages
RPM (Schmitt & Klein, 1999)	Many feedback loops	Situation awareness not part of planning process No development of ECOA
	Wargaming takes form of mental simulation by which coordination issues are resolved and contingencies are developed	No description of sub-functions
	Model shows embedded boxes showing that steps aren't mutually exclusive	
	Model shows time process along a time scale	
PUT (Thunholm, 2005)	Situation assessment included as part of planning process	The reasoning behind understanding mission before situation assessment Is questionable
	Defining explicit criteria of success (e.g. element of surprise, local	Redundant numbering is confusing (i.e. Step 2, sub-step 2)

Model Reviewed	Advantages	Disadvantages
	superiority)	
	Provides a list of outputs	
	Model is flexible and prescriptive in that it states how steps that can be excluded in situations of extreme time-pressure	
Accelerated Decision-Making Model (Kievennar, 1997)	Increased communication with lower formations - 4 warning orders issued	Mission analysis separate from COA development
	Outlines some lower level functions	Wargaming separate from COA development
		Linear process
Abbreviated Military Planning Process (Whitehurst, 2002)	Eliiminates COA comparison and approval steps as only 1 COA is developed by Comd (therefore more efficient process)	Intention of wargaming is not to synchronize COA
	Critical thinking (i.e. "crystal ball") technique used to identify assumptions, gaps in mental model and contingency planning (i.e. branches & sequels)	
	Defines lower level functions	
	Considers group decision making biases (e.g. groupthink)	
	Provides explicit steps to develop enemy COA (ECOA)	

The following features were identified as being common to all intuitive planning models reviewed:

1. There is only 1 COA developed;
2. The Commander selects a single COA based on experience; and,
3. Wargaming is used for synchronization rather than comparison/evaluation of COAs.

It was therefore determined that these features should be incorporated into our intuitive planning model and were therefore added to our wish list.

Previous work for this project (Bruyn, Rehak, Lamoureux & Vokac, 2005) was also reviewed to determine general pattern of functions performed by Brigade– level planning teams in the context of an operational exercise. This information was added to the overall wish list of elements to be included in the intuitive planning models.

Based on the review of existing or proposed intuitive planning models and the results of previous work for this contract, the following "wish list" for the intuitive planning process was created:

- Skeleton COA and mission analysis simultaneously;
- Criteria for success;
- Emphasize steps that can be excluded;
- Situation assessment in planning process;
- Steps are not mutually exclusive;
- Model should include timescale;
- ECOA development;
- Feedback loops;
- Description of sub-functions;
- More frequent Warning Order (or other form of communication) to lower formations;
- Make it specific or adaptable to current CF operation/mission types;
- Identify assumptions, gaps in mental model, branches and sequels;
- Comd present for mission analysis & COA development;
- Make explicit who replaces Comd if absent (i.e. Chief of Staff (COS));
- Design it so it is apparent that it is not a step-wise, linear process; and
- Want to keep terminology consistent with OPP.

In addition to the wish list, there was a desire to promote the level of acceptance and face validity of the new intuitive planning model by:

- Maintaining terminology used in OPP & CFOPP (e.g. Comd's intent, wargaming, mission analysis, COA development);
- Maintaining outputs generated (e.g. mission statement);
- Maintaining planning tools used;
- Ensuring that staff still has meaningful role in planning process (i.e. Comd not doing everything); and
- Ensuring realistic requirements on Comd's /availability time (i.e. Comd's presence not required for all steps).

2.2 Results

2.2.1 Creation of overall model

A model of the overall IOPP with the highest level functions was created to incorporate as many elements from the wish list as possible. There were several iterations based on feedback from project members, the Scientific Authority and a retired military Subject Matter Expert (SME) who was well versed in the OPP.

The final overall model of the OPP, showing the highest level steps only, is shown in Figure 3.

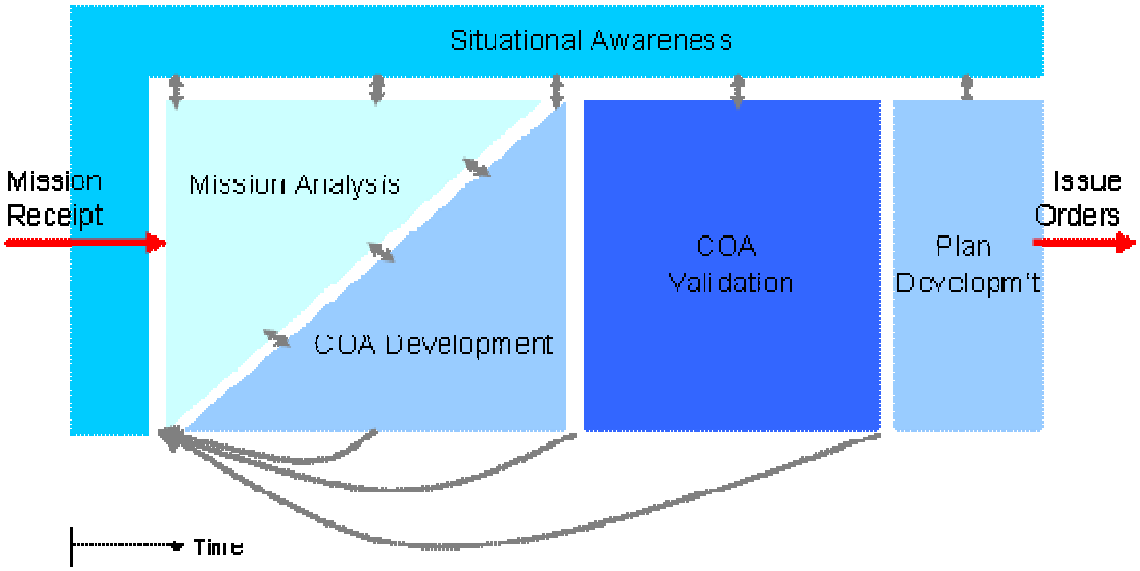

Figure 3: Intuitive Operational Planning Process (IOPP)

The model consists of 5 steps, each of which comprises several sub-steps which are discussed below. The five high level steps include:

1. Situational Awareness (SA);
2. Mission analysis;
3. COA Development;
4. COA Validation; and
5. Plan Development.

The input or trigger to initiate the IOPP is receipt of a mission from higher command. The output of the IOPP is the issue of orders to lower command.

Key features of the overall IOPP model include:

- Feedback loops from COA development, COA validation and Plan Development to the beginning of Mission Analysis;
- The concurrent performance of Mission Analysis and COA Development (shown by the adjacent triangles as well as the double arrows between the two processes);
- The continuous reciprocal input and feedback from SA to every other high level function in the IOPP; and
- A time scale across the bottom to show functions against the progression of time, with the proportions of each step representing the approximate amount of time that it is anticipated that a planning team will spend on each step.

The continuous reciprocal input to, and feedback from, SA to every other high level function in the IOPP is a significant feature of the IOPP. The overall IOPP model illustrates that a certain amount of SA must be attained prior to the start of mission analysis. As the Commander and

Staff work through the planning process, they increase their SA (i.e. awareness of enemy situation, own situation, battlespace environment, other military and civilian resources) and this feeds directly into the development and refinement of the COA. Conversely, it is highly probable there will be factors identified during mission analysis, COA development, COA Validation and Plan Development that help to build the SA of the Commander and the Staff.

The feedback loops along the bottom of the model were included primarily because in the IOPP a single COA is developed at one time. Therefore, it is crucial that this COA is tested and validated thoroughly before it is accepted to be developed into a CONOPS (Concept of Operations) and finally Orders. It must therefore be emphasized that, at any point in the IOPP, if it becomes clear that there are any weaknesses, limitations or ambiguity associated with the COA that is being developed, it can either be subjected to mission analysis again or another COA can be selected and developed.

The concurrent performance of mission analysis and COA development was intentional as it was felt that the initial identification of a COA by a Commander would likely occur during the review of own and higher factors, deductions, assumptions, assigned tasks and objectives. As mission analysis continues and Staff define the most likely enemy COA, it seems logical that the COA would become more developed and refined in the minds of the Commander and Staff.

The next step was to decompose the high level functions of the IOPP into a number of lower level functions. The exact lower level functions that were subsumed within each higher level function was based on previous work, knowledge of what planning products of the existing OPP should remain, review with an SME and consideration of typical Canadian operations and missions. The lower level functions were divided into functions performed by Higher Command, the Commander, the Staff and Lower Formations to show the interaction between the players involved in the planning process. These interactions can be seen in the final model shown in Annex A.

Highlights of this model include:

- The development of only 1 COA at a time;
- Mental wargaming as opposed to traditional wargaming; and
- Continuous situational awareness throughout the process.

The model also included a number of accompanying notes to provide further explanation for each of the steps within the process. These notes can be seen in the final model shown in Annex A.

The model was initially designed with the intent that the process would be depicted as something other than a step-wise linear process like the OPP. However, this proved more difficult than initially thought. It was quickly realized that creating a process in enough detail to be able to train individuals in it requires the process to be presented in a systematic fashion.

Similar to the overall IOPP model, the model of the lower level functions within SA, COA Development, COA Validation and Plan Development underwent several iterations based on feedback from an SME, the Scientific Authority and other project team members. As previously noted, the final version IOPP model showing the lower level functions is included in Annex A.

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3. Development of Training Course for Btn/Bde Staff

3.1 Determining overall requirements for training courses

3.1.1 Format

To allow distance education and flexibility in the delivery of training, a web-based course was developed for the IOPP and OPP. This course was not be location or time dependent for the participants; they could take the training at their own pace and at their choice of location. Of course, the distance learning format placed certain constraints on the way in which the training material was presented. All content, for example, had to be contained in the training itself as there would be no lecturer present to expand on any of the points made in the training. It was also necessary to create a means to track participation in the training to ensure that it was completed by participants. Participation was monitored in two ways. First, the participants were required to login to the training website, and certain web statistics such as login ID, total time logged in, slides viewed, etc., were calculated. Second, quizzes were placed at the end of each training module. Participant answers to the quiz questions were tracked to ensure that they successfully completed each quiz.

An administrative email address was created to provide support in the event that participants encountered difficulties. Participants could send email at any time to report difficulties or ask questions about the training. The support staff responded to emails in a timely manner.

To ensure the equitable comparison of the IOPP and OPP, two equivalent training programs were developed: one for the OPP and one for the IOPP. Although it was assumed (and a requirement when sourcing participants) that participants would have experience with the OPP, some refresher training was desirable. To increase the likelihood that participants would approach the OPP and IOPP with similar levels of understanding, the IOPP training was of a degree of comprehensiveness similar to that of the OPP. Participants were expected to have greater experience with the OPP because it is the doctrinal process of the CF.

Many examples were incorporated in the training materials to make the training easy to assimilate and relevant to the participants. However, time and resource constraints precluded the development of an example of sufficient scope that it could be developed through the course of the training to illustrate all lessons. Instead, unrelated examples were implemented to provide context to the lessons being learned.

The training was created in PowerPoint mainly for ease of creation, but also because it could easily be incorporated into and downloaded from a website. Also, it was determined that there was no requirement for animation so a format such as Flash was not required.

The training was designed with the consideration that there would not be an instructor present to provide context or refer back to the main objectives or points during the course of the training. That is, in the introductory slides of both training courses it was stated clearly why the training was developed and what the purpose of the training was. Second, at the end of each training

module, a review is provided of what the participants have learned up to that point in the training.

3.1.2 Usability

The overall presentation of the training was designed according to general usability principles. The training was divided into a number of individual modules so that participants could complete the training one module at a time and there were a number of logical places to take a break and then return to the training. First, the ability of the participant to see where he is in the overall training was incorporated (see Figure 4 and Figure 5). Figure 4 shows the way in which each step within the process was linked back to the overall model (i.e. highest level functions). This was shown at the beginning of each module within the training. Figure 5 shows the way in which the participant could identify which specific sub-step within each step (in this case Mission Analysis) was being discussed in the training. Each sub-step was identified in a similar manner (i.e. with a red circle).

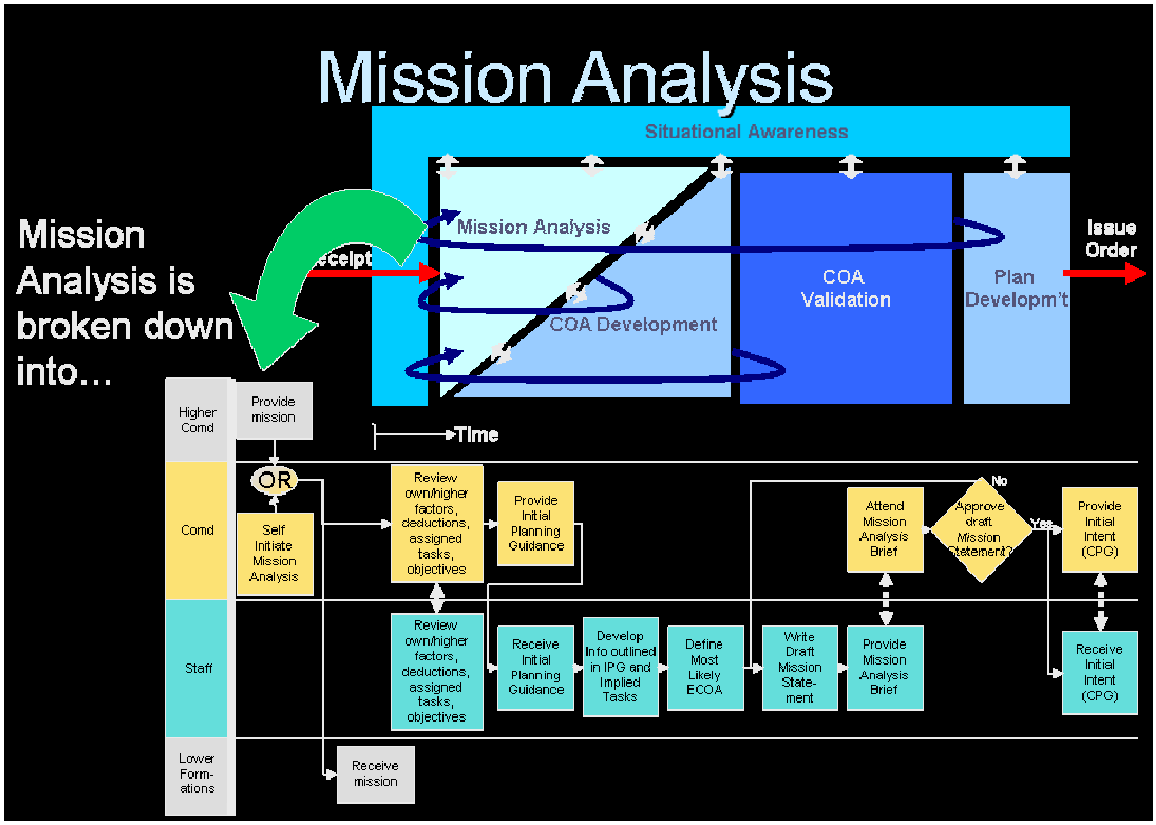

Figure 4: IOPP Training showing both detailed process and overview

As noted above, the online format provided access to help at any time through the ability to email the training administrator. The training also ensured the repetition of the main points; training modules included an overview page, a summary page and quiz questions addressing the most important points of each module. This repetition also aided in memory retention. Finally,

general readability and presentation (i.e. colour coordination) was considered in the expectation that participants would undertake the training on screen rather than as printed material.

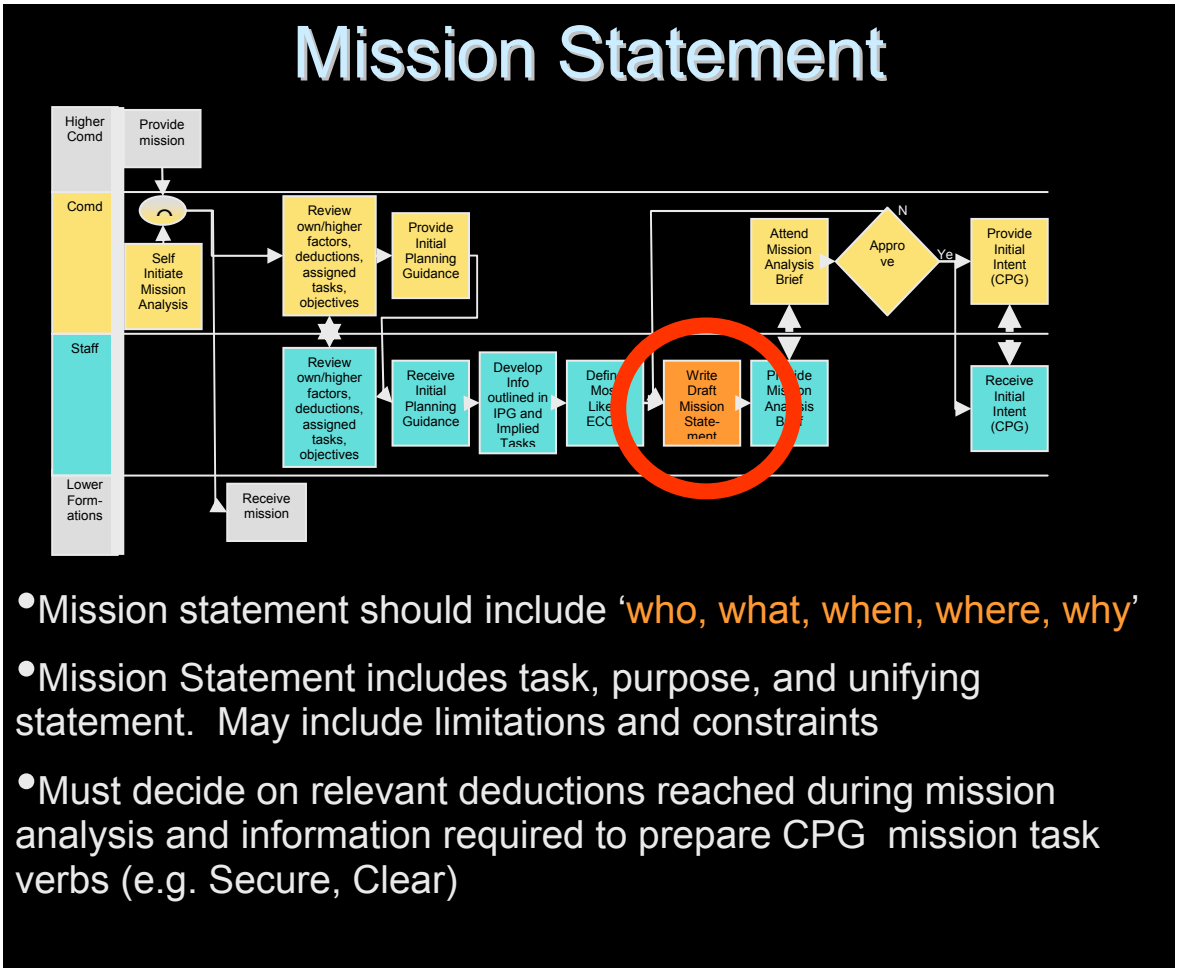

Figure 5: IOPP showing location within Mission Analysis step

3.2 Creating content for OPP training

Initially it was intended that the OPP training would be a refresher course and therefore not provide as much detail as the IOPP training course. However, in the end the level of detail provided in both the OPP and IOPP training was comparable. That is, the inputs, processes and outputs described for individual steps of the OPP and IOPP were at a similar level of detail.

The content for the OPP training was adapted from a tabular task analysis of the OPP (Bruyn, Lamoureux and Vokac, 2004). Within the tabular task analysis, the goals, key decisions, outputs and comments for each step of the process were incorporated into the training. The original function flow diagrams (Bruyn et al., 2004) were modified so that they could be included on the slides.

Based on the tabular task analysis, it was determined that the following modules would be contained within the OPP training:

- Introduction/background;
- Overall summary of OPP;
- Initiation;
- Orientation;
- COA development;
- Plan development;
- Plan Review;
- Conclusion/summary; and
- Overall summary questions.

3.2.1 Validation

The content of the OPP training, along with all supporting documentation, was validated by an SME who is well-versed in the OPP. This SME is also one of the authors of this paper.

3.3 Creating content for IOPP training

The content for the IOPP training was adapted from the model itself including the accompanying notes. The first step was to create a PowerPoint presentation from the initial FlowCharter model. Individual modules within the training were created according to the steps within the IOPP model. Points on the slides were initially created from the notes that were created to accompany the model. Additional content was added until it was felt that there was a sufficient level of detail or explanation for each step within the process. Again, the fact that the training was designed to be standalone (i.e. with no lecturer) was taken into account when determining the level of detail or explanation required for each step of the process.

Based on the IOPP module, it was determined that the following modules would be contained within the OPP training:

- Introduction/background;
- Overall summary of IOPP;
- Situational Awareness;
- Mission Analysis;
- COA Development;
- COA Validation;
- Plan Development;
- Conclusion/Summary; and
- Overall Feedback Questionnaire.

As part of the development of the IOPP, it was recognised that there are certain outputs or products of a planning process that are required to be passed down to subordinate units. Thus, a few of the products produced by the OPP were retained in the IOPP such as Initial Intent, CONOPS and final Plan or Orders. These products were maintained in order to keep the type of information sent to lower formations consistent with the OPP, thereby not disrupting the planning process of lower formations.

It became apparent during the creation of the training that difficulties exist in the creation of a training course for an intuitive planning process. Initially, a goal of the IOPP was to keep it less systematic than the OPP in keeping with the less structured format of intuitive processes. However, because the IOPP is a new process that must be taught and certain products of the OPP could not be eliminated, the IOPP as outlined in the training turned out to be a somewhat systematic process itself. Also, it was thought that perhaps the IOPP would have more face validity if it was not a complete departure in every respect from the planning process that is currently in existence. It is postulated that, although initial training in the IOPP needed to be systematic, later training could ultimately focus on experiential learning (i.e. many case studies) which would furnish the Staff with the confidence to apply the IOPP intuitively.

3.3.1 Preliminary validation

The content of the IOPP training was reviewed by the Scientific Authority as well as a military SME who was involved in the creation of the IOPP and knowledgeable of the OPP. This is the same SME referred to earlier in the paper and is one of the authors of this paper.

3.2 Additional materials

In addition to the PowerPoint training courses themselves, additional materials were provided for participants on the training website. These materials included a summary of instructions to download and complete the training, a glossary of terms used in both the OPP and IOPP training that could be downloaded from the site and either saved or printed for reference, a copy of the OPP and IOPP models for participants to download or print for reference, and an online participant feedback questionnaire. Participants were requested to complete the questionnaire following the completion of both the OPP and IOPP training.

3.3 Pilot testing

In the first phase of pilot testing, both the OPP and IOPP training courses were pilot tested internally to allow an approximation of level of effort (i.e. amount of time) to complete each course. Two internal participants (i.e. employees of Humansystems®), with no familiarity with the OPP, were able to complete each of the OPP and IOPP training courses in approximately two hours. We did not test participant retention of the training as the aim of this pilot testing was to identify formatting or spelling errors as well as predict the level of effort to complete the training. Further, we felt that non-military people would not retain the material as well as military people.

The second phase of pilot testing involved external participants (military personnel with knowledge of the OPP) accessing the website, downloading the training and additional materials

and completing the training modules. The intent of this training was to approximate the level of effort required by military personnel to complete the training courses and also to detect any technical difficulties related to downloading materials, emailing the administrator and collecting web statistics. This pilot testing confirmed that participants were able to email the administrator and web statistics could in fact be collected. The testing also identified certain technical difficulties related to downloading the training courses which were then investigated and resolved by the HSI® project team.

3.4 Results of training with participants of experimental evaluation

All 12 of the participants of the experimental evaluation (refer to Section 4 of the report) were able to successfully log onto the website and download the training courses. Although web statistics, such as the time of login and logoff, were successfully captured, due to the format of the data collected, it was impossible to tell if participants were logging off from one session or logging in for another session. Therefore any calculations of average time to complete training would not necessarily be valid because most participants logged in and out multiple times. Furthermore, participants were unable to submit the feedback questionnaire. These faults should be addressed in future experiments involving the OPP and IOPP online training.

3.4.1 Feedback from participants

An online feedback questionnaire was provided as part of the online training. Participants were requested to complete the feedback questionnaire after completing each of the training packages (i.e. OPP and IOPP). Participants were asked to rank 12 characteristics of the training on a five-point scale (1=very dissatisfied, 5=very satisfied). Unfortunately, due to technical difficulties, participants were unable to submit the questionnaire. As such, participants were asked to complete a hard copy of the feedback questionnaire during the experiment. Only 7 feedback questionnaires were completed and the feedback provided was for the training as a whole rather than for the OPP and IOPP individually, making direct comparisons of the OPP and IOPP modules impossible. Figure 6 below shows the average rating for each characteristic and individual participant ratings are provided in Annex B. Results suggest that participants were satisfied with the convenience of the training, relevance of the training to their work, and the information imparted in the training. Even though participants like the convenience of the web-based training, during the AARs, a number of participants stated that they would prefer lecture-based training with an instructor present.

Participants expressed the greatest dissatisfaction with the inability to have questions answered in real time during the training and the level of detail of the examples (e.g. of planning products) used in the training. Participants were told that emails received between 0830h-1700h Monday-Friday would be responded to within two hours. Outside of those hours, participant emails would be responded to as soon as possible. It appears that participants would have preferred more availability by the administrator. It was also noted that some participants were not able to email the administrator due to technical issues. With respect to the use of examples, comments made during the After-Action Reviews (AARs) conducted during the experimental evaluation suggest that participants would have liked more concrete examples, especially of the planning products or output. In fact, one team suggested the use of JPEG or MPEG files showing specific

planning products either being produced or completed. Participants also suggested the use of one standard example for both training processes to allow easy comparison.

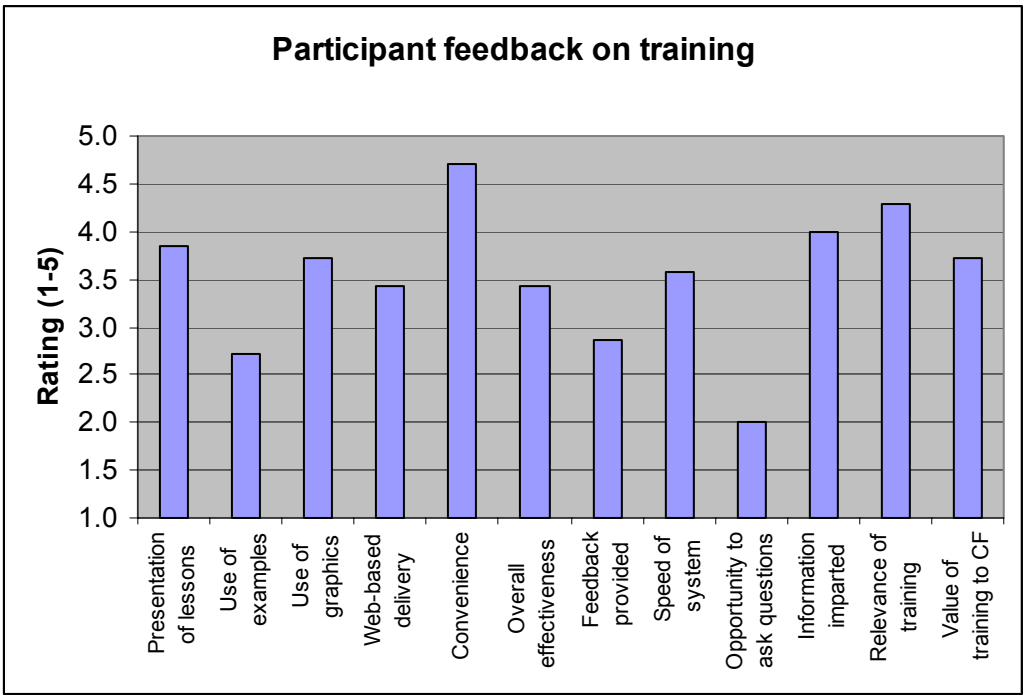

Figure 6: Mean participant ratings of online training

Other participant comments that were raised during the AARs regarding the web-based training include:

- Not enough questions to confirm retention;
- Acronyms not explained and not in glossary;
- Graphics written over text; and
- OPP/IOPP lessons were for a Brigade staff but it was applied at a battle group level.

The last comment suggests that the training may not have been relevant for the context of the exercise in which the OPP and IOPP were applied (i.e. battle group HQ). This should be taken into account for future experiments.

Given the available time and resources, however, the online training was a significant accomplishment. Future opportunities to develop an online or distance learning course for the IOPP and the OPP would build on the work already done; it would not adopt a significantly different approach or significantly different content.

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4. Design and Method of the Experimental Evaluation of the Intuitive Planning Process

An experimental evaluation of the IOPP was conducted to compare the performance of planning teams using the OPP and the IOPP.

4.1 Method

4.1.1 Participants

A total of 12 participants from the reserve CIMIC (Civil Military Cooperation) unit of Land Force Central Area (LFCA), were randomly assigned to two teams of six, each representing a planning team at the Task Force (i.e. Battle Group) level. Specific roles of the staff within each team included:

1. The Commander;
2. IO Officer;
3. Ops Officer;
4. ISTAR;
5. Fires (gunner); and
6. Logistics.

All participants completed both OPP and IOPP online training prior to the experiment. As well, all participants had completed formal training in the OPP at either the Canadian Forces College (CFC) or the Canadian Land Force Command and Staff College (CLFCSC) in Kingston. Immediately prior to each experimental session, all participants received one hour of refresher training on the planning process they would be using for that session (i.e. IOPP or OPP).

Prior to the experimental sessions, participants were asked to complete a background questionnaire detailing their participation in planning exercises or operations as well as the amount of training they have received in the OPP. Although it was requested that all participants have a basic familiarity with the OPP, results of the background questionnaire revealed that four participants had never received any formal training in the OPP. Three participants reported that they have received a moderate amount of training in the OPP, while only one reported having considerable training experience with the OPP. The remaining three participants reported that they have attended one or two lectures on the OPP, although the location (e.g. CFC) nor context (e.g. part of advanced military studies course) of the lectures was reported. In terms of operational experience using the OPP, five participants reported having no operational experience, six participants reported some experience and one reported a moderate amount of experience.

4.1.2 Observers

A total of four observers from the HSI® team, along with two research assistants (RAs) from DRDC Toronto, were involved in the experimental evaluation. One observer and one RA were available for each planning team on each day of the training (two days total with the two planning teams working concurrently). The HSI observers stayed with the team throughout the two days, while the DRDC RAs stayed with the process being applied (and thus observed two different teams).

Two military SMEs acted as expert evaluators throughout the experimental exercises. One evaluator was present for each experimental session (i.e. one team with either the OPP or IOPP).

A scenario description as well as well as orders from higher command were provided to all observers including RAs and expert evaluators. This permitted observers to know what key factors, activities, or behaviours are expected so as to make their rating task easier. In addition, all observers received a training session on Measures of Performance (MOPs) to capture, how to identify MOPs, etc.

4.1.3 Design

One group of 6 participants was named 'yellow' and the other group named 'blue'. A mixed between and within-groups design was adopted. To control for learning and/or order effects, the Blue team applied the OPP on the first day of the experiment and the IOPP on the second day, whereas the Yellow team applied the IOPP on the first day and the OPP on the second day. Both groups were presented with the same scenario (a defensive operation) on the first day, and the same scenario (an offensive operation) on the second day. Each group was assessed on planning effectiveness, planning efficiency, and overall performance. Between the groups, the quality of the planning products, as well as time-based measures of efficiency, were used to compare the relative effectiveness of the OPP and the IOPP. Specific measures of performance (MOPs) are outlined in section 4.1.7 of this document.

4.1.4 Equipment and materials

The simulated planning experiment took place in two separate training rooms at CFC in Toronto. Equipment provided for each team included 2 laptops containing software for word processing, making presentations, creating spreadsheets and visualizing data, 1 whiteboard, 1 flip chart with paper, talc (for creating overlays), pens and pencils, etc.

The planning teams used the laptops, whiteboards, flipcharts and talc for the majority of their planning activities. Products such as the Commander's Planning Guidance, CONOPS and Orders were created using available word processing software or handwritten on paper. Planning tools (e.g. COA comparison matrix) were produced using commercially-available software.

Presentation of the orders at the completion of each planning session was videotaped and audio recorded for the purpose of post-exercise analysis only. Therefore two sets of video and audio recording equipment were required for the duration of the experiment (one for each team).

At the start of each experimental task (i.e. planning session), participants were provided with the following materials and information:

- A general narrative of the exercise describing the current situation as well as opposing and own force activities up to the point of the beginning of the scenario. It also defined the current scenario time;
- The start states for own forces;
- ORBATs (Order of Battle) for own and enemy forces;
- Area map (1:50,000) showing the Area of Operations (AOO) and the geography and terrain;
- Decision support template;
- Synchronization matrix;
- An OP O (Operations Order) from highest command;
- A Frago O (Fragmentary Order) from higher command that outlines, among others, the situation, mission and execution;
- Intelligence Summary (INTSUM);
- Task Organization Matrix;
- ISTAR Matrix;
- Attack Guidance Matrix;
- Groupings and Taskings Matrix;
- Overlay (photocopied onto 8.5 x 11 paper) showing blue forces, and,
- A poster showing the OPP or the IOPP (depending on the experimental condition).

During both the OPP and IOPP planning sessions, the participants were able to use their own resources required to perform the planning task (e.g. Battle Staff Smartbook).

4.1.5 Experimental Task

The simulated planning experiment took place on February 18 and 19 at CFC in Toronto. Participants played roles in one of two simulated planning staffs and created a plan, using both the OPP and IOPP for two scenarios. The two planning teams were located in separate rooms (see Figure 7).

Figure 7: Experimental facilities for Yellow team

Each team was presented with a scenario and given a mission and the Commander's planning guidance and then asked to create a plan for lower formation(s). Initial mission tasking (i.e. HICOM) and Commander's guidance was provided by the LCol (Ret'd) on the HSI® team.

The manner in which each team followed and applied the planning process was observed and documented by HSI® team observers, RAs and the two expert evaluators. In general, the observers documented timings, steps in the planning process that were followed (and steps that weren't followed), errors and any other relevant observations. A complete inventory of MOPs collected by observers as well as participants is provided in section 4.1.7.

Parallel experimental sessions were conducted in order to minimise the impact on project resources. That is, the two planning teams performed the experimental task concurrently, although in separate rooms.

The experimental session took place over two days (0800h – 1600h) and included refresher training on both the OPP and IOPP. A general experimental briefing was held on an evening the week prior to the experiment. At this point a general description of the scenario was provided as well as an overview of the logistics of the experiment (expected hours, etc.). Each team was asked to run through at least one planning cycle for both the OPP and IOPP.

4.1.5.1 Planning products

The planning products created by the participants during each experimental session differed for the OPP and IOPP, as certain OPP products are not relevant when using the IOPP for planning. Table 2 shows the outputs that the planning teams were asked to produce for both OPP and IOPP experimental sessions.

Table 2: Planning Products for the OPP and IOPP

OPP	IOPP
Initial Intent	Initial Intent
Wng O to subordinate formations	Summary of Mission Analysis (replaces Mission Analysis Brief)
Mission Analysis Brief including mission analysis and key deductions	Most likely enemy COA
Commander's Planning Guidance	Skeleton COA
Information Brief (with three friendly and three enemy COAs, including most dangerous and most likely)	Criteria for success
Decision Brief	Refined COA
CONOPS	Final, validated COA
Plan/Orders	CONOPS
	Final Plan
	Branch and sequel plans (if applicable)
	Orders

4.1.6 Scenarios

Two separate paper-based scenarios were used to avoid potential learning effects. The use of the scenarios was counterbalanced such that planning team yellow used the OPP with scenario A then the IOPP with scenario B, whereas team blue used the IOPP with scenario A then the OPP with scenario B. The scenarios were adapted from existing CF scenarios that are currently used for training at CLFCSC in Kingston. As such, they were appropriate for the Task Force (i.e. Battle Group) level. One scenario entailed a defensive operation whereas the other involved an offensive operation.

The scenarios were designed to be of similar complexity such that identical MOPs were applicable to both experimental conditions and both scenarios. In order for us to be able to assess the perceived similarity of the scenarios in terms of complexity, a measure was used that allowed the participants to rate the level of complexity of each scenario (i.e. manipulation check; see Section 4.1.7).

4.1.7 Data Collected

During the experimental sessions, the observers and SMEs documented the actions of their respective planning teams. Within each team, the three observers (including HSI® and DRDC

observers) divided responsibility for observing participants such that each observer was responsible for following two team members and documenting their activities. In general, the participants observed were paired according to their role role and with whom he was most likely to be collaborating. For example, one observer was responsible for the OpsO and AOpsO given that they worked most closely together. Likewise, the Comd and IO, and FOO and LogO were paired for observation purposes. For the duration of each experimental session, observers documented the time (clock or according to a countdown timer), activity and appropriate OPP or IOPP step performed. The majority of the mapping of the team activity to appropriate OPP or IOPP step was done post hoc (although some observers did this in real-time). The two SMEs were also asked to document timings and observed activities for the duration of the experiment. However, as there was just one SME per team, their observations are with reference to the entire planning team rather than two individual members of the team. The observations documented by the observers and SMEs are provided in Annex C.

One limitation of this observation method is the fact that all OPP and IOPP steps are not necessarily explicit and therefore it may be difficult for observers to identify exactly which step is being performed. There are some steps that are certainly more observable than others. For example, formal briefings such as the Mission Analysis Brief (Step 2.6 in OPP and 2.7 in IOPP) or Decision Brief (Step 4.2 in OPP) are easily observable. However, functions such as the Commander deciding if he has sufficient information to initiate COA Development (Step 3.1 in IOPP), or the decision as to whether the staff is performing crisis action planning (Step 1.8 in OPP) may not be as readily observable.

4.1.7.1 Measures of Performance

Measures of performance enabled a direct comparison of the OPP and the IOPP across a number of dimensions. Given the design of this experiment, different MOPs were collected by different individuals in order to evaluate the planning process. Specifically, MOPs were divided into measures that were generated by expert (military SME) evaluators who were observing the experiment, measures generated by the participants themselves, and measures generated by the HSI® team of observers and DRDC research assistants (referred to collectively as observers). MOPs addressed both the planning process and planning products.

Table 3 outlines a number of MOPs that SME evaluators completed during both experimental conditions (i.e. both planning processes). MOPs for SME evaluators included subjective measures related to the quality and efficiency of the planning process and the quality of the planning products (i.e. the Plan or Orders). Rating scales used by the SME evaluators were in the form of a modified Behaviourally-Anchored Rating Scale (BARS). Each rating scale listed a number of behaviours or characteristics to look for in rating the factor (e.g. quality of plan) but did not provide specific behavioural descriptors for each rating value (i.e. what behaviour is associated with "poor"). The following section includes a discussion of BARS as a rating scale methodology. The BARS used by the SME evaluators for the purpose of this experiment are shown in Annex D.

Table 3: MOPs used by expert SME evaluators

Dimension	Potential objective measures	Potential subjective measures
Planning process	Number of steps in planning process missed, repeated, performed out of order or concurrently	Rating of perceived quality of Mission Analysis process[1] Rating of perceived quality of Commander's guidance Rating of perceived quality of Staff Analysis process Rating of perceived quality of COA Evaluation/Validation process Rating of overall efficiency of team when applying planning process
Planning product(s)	N/A	Rating of quality of selected COA Rating of quality of CONOP Rating of overall quality of Plan Rating of overall quality of Order

Table 4 outlines a number of MOPs that were collected by HSI® and DRDC observers while observing both experimental conditions (i.e. both planning processes). This list includes only objective measures of the planning process itself, such as time to complete plan, number of communications, etc.

Table 4: MOPs used by HSI® team observers and RAs

Dimension	Potential objective measures	Potential subjective measures
Planning process	Time to select COA Time to complete CONOPS Time to complete Plan Time to complete Orders Requests for additional information or clarification Number of steps in planning process missed, repeated, performed out of order or concurrently Total errors made in planning process Number of team briefings observed – both formal and no-formal (Note number of participants) Number of options presented to commander Number of non-mandated steps added to the process	N/A

Table 5 outlines the MOPs that were completed by the participants, including:

[1] This would also be an indicator and a potential measure of situation awareness

- Subjective and objective measures of the planning process (e.g. usability, user trust/confidence, reliability, etc.);
- Subjective measures of the planning products (e.g. user trust/confidence, reliability, overall quality, etc.); and
- Manipulation checks of scenario complexity and realism of time pressure.

Participant MOPs, other than workload measures, were collected at the end of the day for each experimental condition (i.e. OPP and IOPP). Rating scales for participants were created using a Likert 5-point scale and are shown in Annex E. Rather than using standard anchor terms, anchors were selected according to the dimension being rated. BARS were not used for participant MOPs.

Workload measures, using the NASA TLX (Task Load Index) Questionnaire, were completed by the participants twice for each experimental condition; halfway through the day and at the end of the day.

Table 5: MOPs used by Participants

Dimension	Potential objective measures	Potential subjective measures
Planning Process		
Usability	N/A	Rating of ease of use of planning process Rating of learnability of planning process Rating of efficiency of planning process Rating of effectiveness of planning process Rating of overall user satisfaction with planning process
User trust/confidence and reliability	N/A	Rating of user trust/confidence in planning process Rating of reliability of planning process to produce a good plan
Accuracy/Errors	N/A	Rating of potential for planning process to lead to errors in overall plan Rating of potential criticality of errors in overall plan that may be associated with planning process
Operational effectiveness	N/A	Rating of suitability of planning process in a variety of operational contexts Rating of degree to which the team followed the process
Workload	N/A	Rating of complexity of planning process Real time subjective ratings of workload

Planning Product(s)		
User trust/confidence and reliability	N/A	Rating of user trust/confidence in the overall Plan to complete the mission Rating of reliability the overall Plan to complete the mission
Accuracy/Errors	N/A	Rating of accuracy of the overall Plan in completing the mission
Overall quality	N/A	Rating of overall quality of Plan
Manipulation Checks		
	N/A	Rating of realism of scenario Rating of realism of time available for planning

4.1.7.2 Rating Scales

Meister (1985) notes that rating scales may be used to:

- Evaluate how well a task is being performed (e.g. following a plan precisely)
- To evaluate some quality of performance (e.g. leadership of the OC during mission planning);
- Quantify the adequacy of some feature of a system (e.g. the detail of navigational plan);
- Evaluate the effect of some condition (e.g. critiquing aid versus existing practice); and/or
- Evaluate the output of performance (e.g. the choice of a tactical strategy).

While there are a number of approaches to the construction of ratings scales, BARS have emerged as a preferred technique because the behavioural descriptors assigned to each item's rating scale are thought to provide the necessary anchors to enhance the precision of the rating and to standardise across observers.

BARS have also been shown to have good construct validity, and, when used to assess planning performance, have demonstrated a high correlation with assessments of actual operational performance in air combat missions (Spiker, Nullmeyer and Tourville, 2001). An example BAR scale is shown in Figure 8.

BARS has definite advantages over simply asking judges to "rate on a scale of 1-5 the quality of mission briefings". First, the scale defines the behaviour category of interest, in this case "Quality of the Mission Analysis Process". Second, it summarises the range of behaviours of interest relating to the quality of the mission analysis process i.e. the number of factors considered, the relevance of the factor considered and the amount of insight brought to the analysis. Third, it provides descriptors of the performance standard that merit the different rating values. Fourth, it directs the rater to specific key behaviours. Because of these advantages, BARS were used for SME evaluators MOPs..

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
Quality of the Mission Analysis Process				
Many relevant factors not considered	Several factors not considered, including some relevant factors	The most obvious factors were considered but no attempt was made to think 'out of the box' nor were interaction effects between factors considered	All obvious and some peripheral but significant factors considered; interaction effects between factors considered	All potentially significant factors and their interactions considered; high degree of insight brought to analysis
Look for: Many different factors noted during discussion Consideration of how factors might influence each other Inferences made on the basis of known facts Appropriateness of factors considered **Observations:**				

Figure 8: Example BARS

4.1.7.3 Workload Measure

The NASA TLX, which is a retrospective measure of mental workload (Hart & Staveland, 1988), was administered at the mid-point and end (immediately following each experimental session) of each day. This measure was used to compare workload across a number of dimensions including the OPP and IOPP. A retrospective assessment was preferable to a real-time measure for this experiment given that the the work (i.e. planning) was mostly self-paced. The NASA TLX collects ratings for six dimensions (mental demand, physical demand, temporal demand, performance, effort, frustration) along a continuous scale. Each dimension is compared with all other dimensions in a pairwise manner to generate a weighting for each dimension. This permits calculation of a weighted composite workload score.

4.1.8 After-Action Review

Upon completion of each experimental, an AAR was conducted with all participants in each team, SME evaluators, and observers. The purpose of the AAR was to provide an opportunity to discuss the experimental sessions as well as elicit feedback from the participants on the IOPP compared to the OPP and other relevant topics.

4.1.9 Schedule

The experimental evaluation took place over two days, with different planning teams performing the experimental task concurrently. As illustrated in Table 6, the morning of each day consisted of refresher training on both IOPP and OPP along with provision of the scenario to be used for the experimental session. For the remainder of the first day, Team Blue performed the experimental task using the OPP, while Team Yellow did the same using the IOPP. On day two, Team Blue performed the experimental task using the IOPP and with a new scenario while Team

Yellow used the OPP with a new scenario. Working hours for each day of the experiment was 0800h – 1600h with approximately a half hour for lunch.

Table 6: Schedule for the experimental evaluation

Time	Day 1		Day 2	
	Team Blue	*Team Yellow*	*Team Blue*	*Team Yellow*
0800-0830h	Welcome / OPP refresher	Welcome / IOPP refresher	IOPP refresher	OPP refresher
0830-0900h	Scenario briefing	Scenario briefing	Scenario briefing	Scenario briefing
0930h-1530h	Experimental task using OPP and scenario A	Experimental task using IOPP and scenario A	Experimental task using IOPP and scenario B	Experimental task using OPP and scenario B
1530-1600h	AAR	AAR	AAR	AAR

4.2 Results

4.2.1 Data Analysis

Observers and SMEs documented actions observed, the time of action (clock or according to the countdown timer), and the corresponding OPP or IOPP step. The majority of the mapping of the team activity to appropriate OPP or IOPP step was done post hoc. Mapping was done by individual observers and SMEs but was verified by an internal SME.

The data collected by each observer were aggregated and expressed according to a standardized timeline. The result was one data set including time, actions observed and OPP/IOPP step for each experimental session (i.e. each team and each day). That is, four data sets were produced: Team Yellow OPP, Team Yellow IOPP, Team Blue OPP, Team Blue IOPP. The following observer MOPs, outlined in Table 4, were calculated from these four data sets:

- Time to select COA;
- Time to complete CONOPS;
- Time to complete Plan;
- Time to complete Orders;
- Requests for additional information or clarification;
- Number of steps in planning process missed, repeated, performed out of order or concurrently ;
- Total errors made in planning process;
- Number of team briefings observed – both formal and no-formal (Note number of participants);
- Number of options presented to commander; and
- Number of non-mandated steps added to the process

The MOPs generated by the SME evaluators (outlined in Table 3) were collected and analyzed individually and then combined for further analysis.

Participant ratings of the planning process and products (outlined in Table 5), as well as workload ratings collected by means of the NASA TLX, were combined for further analysis.

Data collected from the SME evaluators, observers and participants were compared across a number of dimensions to identify differences, especially differences between the OPP and IOPP. Data from the two experimental teams was also considered for consistency. Given the sample size, descriptive, rather than statistical analyses were performed on the data.

In addition, all notes, overlays, diagrams, etc. created by the participants during the planning exercise, along with video and audio recordings of presentation of the orders, were reviewed and used to supplement and embellish the results of the MOPs and overall discussion points.

4.2.2 Realism of scenario and time available

As a manipulation check, participants were asked to rate the realism of the scenarios as well as that of the time available. Individual participant ratings for both scenarios are provided in Annex H. Figure 9 below shows the average rating of realism of scenario and time available for scenario A (defensive) and scenario B (offensive). Overall, participants found the offensive scenario more realistic than the defensive scenario and that they had a more realistic amount of time available for the offensive than defensive scenario. This suggests that the scenarios may not have been equivalent in terms of complexity or other characteristics. Given that the teams used a different scenario for the OPP and IOPP, it is possible that differences in the scenarios may have contributed to some of the differences in performance or quality of planning process or products. Ratings of both scenarios, however, were above the mid-point of the scale, indicating that participants found both scenarios to have a reasonable degree of realism.

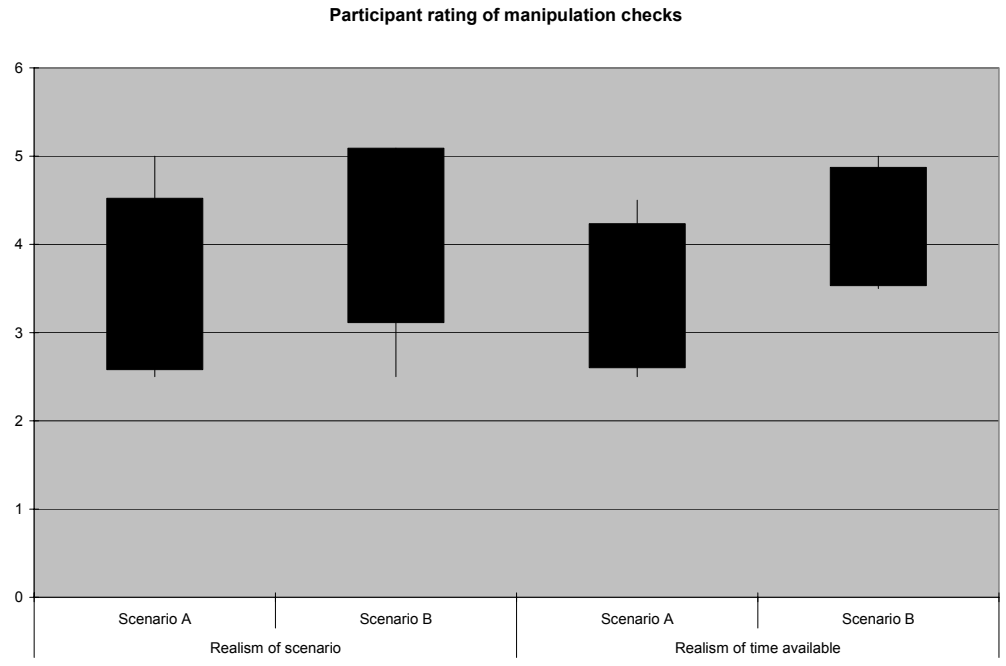

Figure 9: Ratings of realism of scenario and time available

4.2.3 Overview of experimental sessions and planning teams

Each team represented a battlegroup staff. The composition of the planning staff for yellow team was a Commander (Comd), an Operations Office (Ops O), an Assistant Operations Officer (AOps O), a Fire Officer (FOO) or Fire Support Coordinator, Intelligence Officer (Int O) and an Engineer. The composition of the planning staff for the blue team was a Comd, Ops O, AOps O, FOO, Int O and Logistics Officer (Log O).Both teams planned for a defensive scenario on day one. On this day, the yellow team conducted the planning exercise using the IOPP whereas the blue team used the OPP. On day two, both teams planned for an offensive scenario, with the Yellow team using the OPP and the Blue team using the IOPP. The yellow team had a total of 6 participants for the first day then 5 participants for the second day as one participant was unable to attend. The blue team had a total of 6 participants on both days

4.2.4 Overview of steps performed

The OPP and IOPP steps performed by each team in each condition were determined by combining all observer data. The total number of possible steps was calculated from the OPP and IOPP swimlane diagrams that were provided to the teams as reference. As seen in Annex F, the swimlane diagrams show tasks performed by a specific individual or team (i.e. Higher Command, Commander, Planning Staff, Subordinate Formations). Each function or decision point in the OPP and IOPP swimlane diagrams was assigned a number to be used coding purposes and subsequent calculation of the sequence of steps performed (see Annex F).

4.2.4 Total number of OPP and IOPP steps performed

The total number of OPP and IOPP steps performed was calculated for each team and each experimental condition. These data were then averaged across teams and normalized according to the total number of possible steps for the OPP and IOPP (see Table 7). For the purpose of this experiment, teams were asked to terminate the OPP at the end of Plan Development and the IOPP once the Orders had been issued. As such, all steps of Plan Review (Step 6 of the IOPP) as well as the last two steps of the IOPP (i.e. 5.6 and 5.7) were not counted in the total possible steps, leaving a total of 50 possible OPP steps and 37 possible IOPP steps. Overall, the teams performed **72%** of OPP steps and **84%** of IOPP steps.[2]

[2] Calculated as a percentage of total steps in each process, the teams performed **64%** of OPP steps and **79%** of IOPP steps.

Table 7: Total number of OPP and IOPP steps performed

	OPP		IOPP	
	Number of steps followed	Total number of possible steps	Number of steps followed	Total number of possible steps
Step 1	6	9	6	6
Step 2	10	10	9	9
Step 3	11	14	4	6
Step 4	3	4	9	11
Step 5	6	13	3	7[3]
Step 6	0	6[4]	n/a	n/a
TOTAL	36	56	31	39

4.2.5 Time to complete planning process and planning products

The overall time to complete the planning exercise was calculated from the point at which the team actively started planning following the scenario briefing until the Commander had completed his presentation of the final orders. The total time therefore included the lunch break, which was relatively consistent across teams. The times to complete the planning exercise by each team (Blue or Yellow) for each day (1 or 2) are shown in Figure 10. Team Yellow took less time to perform the planning exercise using the OPP than the IOPP. On the other hand, Team Blue took less time to complete the planning exercise using the IOPP than with the OPP. Each team took less time to complete the planning exercise on the second day which is consistent with a practice effect. However, the Blue team, using the IOPP, derived a larger benefit on the second day.

[3] Due to the fact that participants were asked to stop after issuing orders, 5 rather than 7 possible steps could have been performed

[4] Due to the context of the experiment, Step 6 of the OPP was not performed

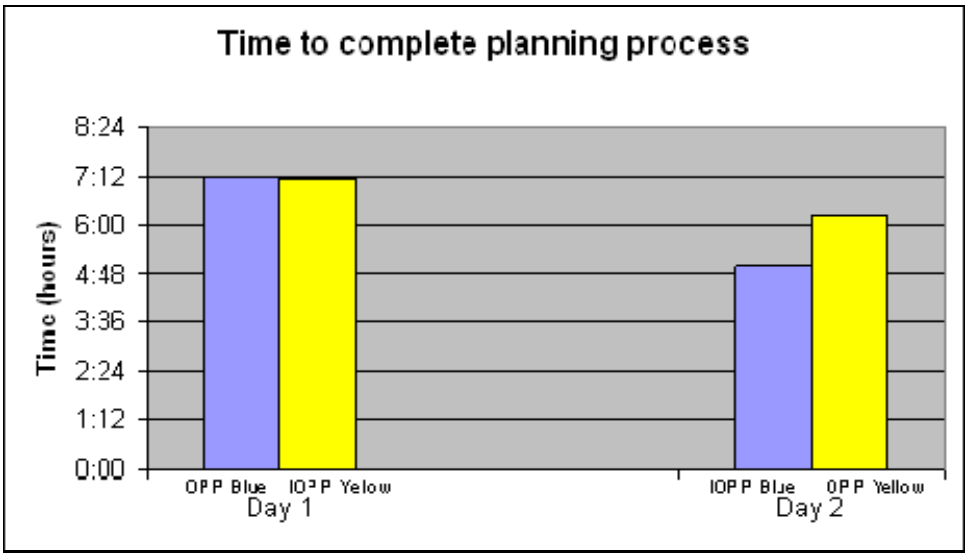

Figure 10: Total time to complete planning process

If the data are collapsed across days and teams, the total time to complete the planning process using the OPP was **6.42 hours** and **6.04** hours when using the IOPP.

The average time to complete the COA, CONOP and Plans/Orders using the OPP and IOPP are shown in Table 8 as well as Figure 11. Times to complete planning products were averaged across teams as well as observers (from a total of four observers). Raw data from each observer are provided in Annex F.

Figure 12 shows the difference in times to complete each planning product from day 1 to day 2. We were not able to calculate a time difference for the Blue team producing the CONOP as they did not explicitly produce a CONOP on day 1. This data shows that the Blue team experienced a significant reduction in time to select COA and time to complete Plans/Orders from day 1 (OPP) to day 2(IOPP). The Yellow team, however, had only a slight reduction in time from day 1 (IOPP) to day 2 (OPP) in completing the CONOP and Plans/Order and, in fact, took longer to select the COA on day 2 compared to day 1. Therefore, the Blue team, which used the IOPP on day 2, showed a larger reduction in completion times (with the exception of time to complete CONOP) than the Yellow team which used the OPP on day 2. This suggests that there was likely a practice effect, especially for the Blue team.

Table 8: Time to complete planning products for OPP and IOPP conditions

	IOPP	OPP
Time to select COA	2:25	5:59
Time to complete CONOP	4:02	5:24
Time to complete Plan/Orders	5:45	6:27

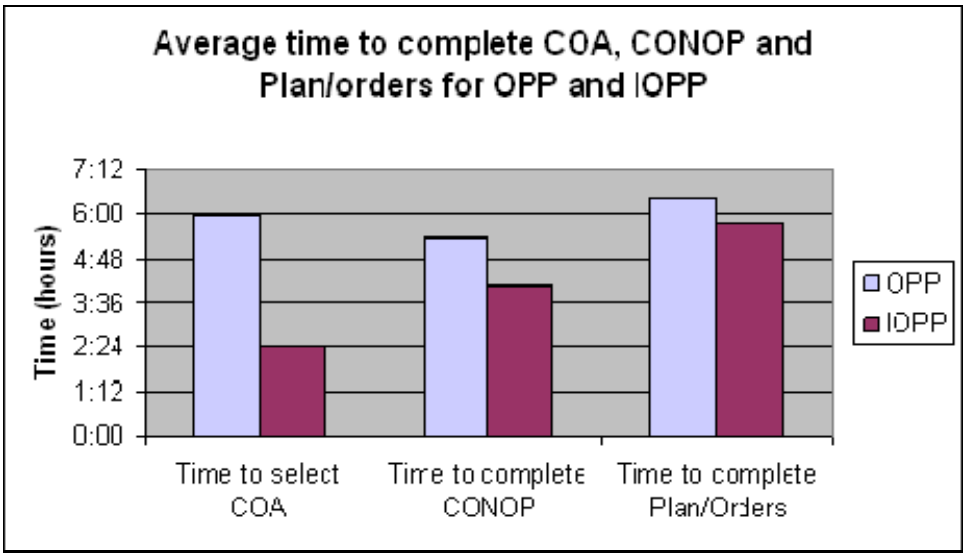

Figure 11: Average time to complete planning products for the OPP and IOPP

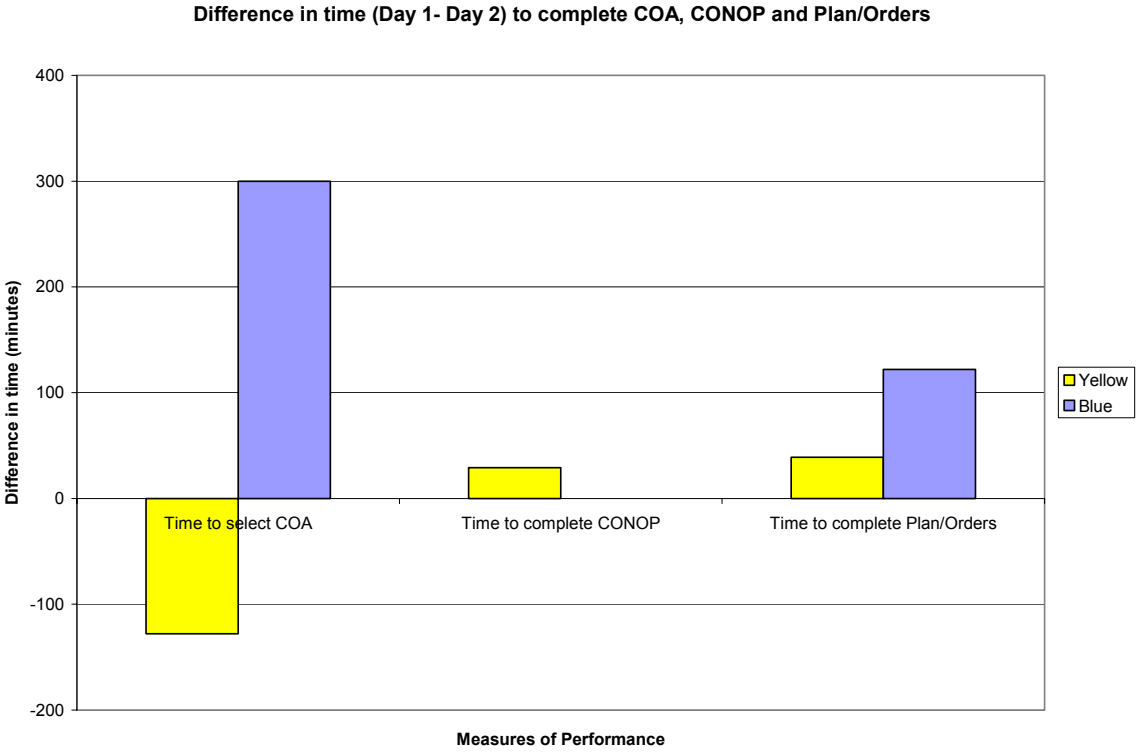

Figure 12: Difference in time to complete planning products from Day 1 to Day 2

4.2.6 Steps in planning process missed, repeated, performed out of order or concurrently

Figure 13 and Figure 14 below show all of the steps performed in the OPP and IOPP, respectively. The shaded areas in each table indicate steps that were performed in full by either of the teams, whereas non-shaded areas indicate steps that were skipped or abbreviated. Some of the steps, for both the OPP and IOPP, were not performed due to the lack of realism with the planning exercise. For example, there were no supporting/subordinate formations so the teams could not pass orders to these formations. Likewise, a synchronization wargame with lower formations, as outlined in the IOPP, was not performed. In addition, given that there were no players for the role of higher command, approval of the CONOP from higher command was not feasible.

As previously noted, teams were asked to follow the OPP until the end of Step 5 (Plan Development) and, as a result, none of the steps in Plan Review were performed. Some of the key OPP steps that the teams chose to skip or abbreviate include testing the viability of own COAs (Step 3.4), the development of branch or sequel plans (Step 5.6, 5.7) and plan wargame (Step 5.8). This is consistent with previous research (Bruyn, Rehak, Vokac & Lamoureux, 2005) and is not surprising in the context of this experiment given the imposed time constraints. With respect to the IOPP, some of the key steps that were skipped or abbreviated include a check that the Commander has sufficient information to initiate COA development (Step 3.1), Commander approval of COA and criteria for success (Step 3.3) and, a check that the COA is refined enough to do staff estimates (Step 4.1).

1.0 Initiation	**2.0 Orientation**	3.3 Staff Develop Initial Enemy and Own COAs	4.2 Decision Brief	*(No - go to 5.11)*
1.1 Mission Receipt	2.1 Staff Review Situation	3.4 Staff Test Viability of Own COAs	4.2.1 Staff Prepare and present decision brief	5.10 Higher Comd decides if Plan is approved
1.1.1 Mission Receipt from Higher Cmd	2.2 Staff Review Higher Level Information	3.5 Information Brief	4.2.2 Comd Attends decision brief	*(Yes - go to 5.11)*
1.1.2 Comd Initiates Mission Receipt	2.3 Staff Develop own Information based on Higher	3.5.1 Comd Attends Information Brief	4.3 Comd selects COA	*(No - return to 5.1)*
1.2 Issue/Receive Initiating Directive	2.4 Staff Develop Mission Statement	3.5.2 Staff Prepare and Present Information Brief	4.4 Staff Develop Concept of Operations (CONOPS)	5.11 Revise Final Plan
1.2.1 Comd Issues Initiating Directive	2.5 Staff Prepare Mission Analysis Brief	3.6 Comd/COS provides further guidance	**5.0 Plan Development**	5.12 Staff decides if issues/shortfalls need to be identified and
1.2.2 Staff Receives Initiating Directive	2.6 Mission Analysis Briefing	3.7 Staff Continues Checks and Analyses of Own	5.1 Staff Further Refines Comd's intent and concept	*(Yes - return to 5.4)*
1.3 Comd and Staff Activate Planning Staff	2.6.1 Staff delivers Mission Analysis Briefing	3.8 Comd decides if any COAs need to be refined	5.2 Comd seeks CONOP approval from higher authority	*(No - go to 5.13)*
1.4 Staff Gathers Planning Tools	2.6.2 Comd receives Mission Analysis Briefing	*(Yes - go to 3.9)*	5.3 Higher Comd decides if CONOP approved	5.13 Issue Final Plan
1.5 Issue/Receive Guidelines	2.7 Additional Guidance	*(No - go to 3.10)*	*(Yes - go to 5.4)*	**6.0 Plan Review**
1.5.1 Comd issues Guidelines to Staff	2.7.1 Comd provides additional guidance	3.9 Refine COAs selected by Comd (as required)	*(No - return to 5.1)*	6.1 Staff conducts progress review of operation
1.5.2 Staff Receives Guidelines from Comd	2.7.2 Staff receives additional guidance	3.10 Comd decides if any new COAs need to be developed	5.4 Staff identifies and resolves issues/shortfalls	6.2 Staff conducts periodic OPLAN/CONPLAN for review
1.6 Comd makes Initial Assessment	2.8 Comd develops Comd's Planning Guidance	*(Yes - go to 3.11)*	5.5 Staff Prepares Plan	6.3 Staff conducts detailed exercise/wargaming
1.7 Initial Comd's Guidance	2.9 Staff Finalize Mission Statement	*(No - go to 3.12)*	5.6 Staff decides if plans for branches/sequels required	6.4 Staff decides if necessary to reinitiate OPP
1.7.1 Comd Issues Initial Guidance	2.10 Comd's Planning Guidance	3.11 Develop New COAs Directed by Comd (as required)	*(Yes - go to 5.7)*	*(Yes - go to 1.0)*
1.7.2 Staff Receives Initial Guidance	2.10.1 Comd Provides Planning Guidance	3.12 Staff Compare Own COAs	*(No - go to 5.8)*	*(No - go to 6.5)*
1.8 Crisis Action Planning or Supporting Formations Known?	2.10.2 Staff Receive Planning Guidance	3.13 Staff Wargame	5.7 Develop plans for branches and sequels	Reinitiate OPP as required
(Yes - go to 1.9)	**3.0 COA Development**	3.14 Staff Identify Branches and Sequels	5.8 Plan wargame	6.5 Update and issue amendments as required
(No - Go to 2.0)	3.1 Staff Review Comd's Planning Guide	**4.0 Decision**	5.9 Comd decides if Plan must be submitted to higher authority for approval	6.6 Prepare and issue plans as required
1.9 Issue Warning Orders to Subordinate/Supporting Formations	3.2 Staff Analysis	4.1 Staff Review Validation/Comparison Information	*(Yes - go to 5.10)*	

Figure 13: Overview of OPP steps performed

1.0 Situational Awareness	2.7.1 Staff provides Mission Analysis Briefing to Comd	3.4 Staff Refine/Develop COA	4.9 Staff develop CONOP
1.1 Awareness of Enemy Situation	2.7.2 Comd Attends Mission Analysis Briefing	3.5 Skeleton COA given to LF	4.10 Comd and Staff present CONOP to Higher Cmd
1.2 Awareness of Own Situation	2.8 Comd Approves Draft Mission Statement?	**4.0 COA Validation**	4.11 Does Higher Cmd approve of CONOP?
1.3 Awareness of Battlespace Environment	*(No - return to 2.6)*	4.1 COA refined enough to do Staff Estimates?	*(No - return to 4.7)*
1.4 Awareness of Other Military and Civilian Resources	*(Yes - proceed to 2.9)*	*(No - return to 3.0)*	*(Yes - proceed to 5.0)*
1.5 Conduct a Meta-Cognitive Check	2.9 Initial Intent	*(Yes - proceed to 4.2)*	**5.0 Plan Development**
2.0 Mission Analysis	2.9.1 Comd Provides Initial Intent (CPG)	4.2 Staff Estimates	5.1 Develop Plan
2.1 Mission Receipt	2.9.2 Staff Receive Initial Intent (CPG)	4.3 Is COA viable?	5.2 Comd and Staff: Synchronization Wargame
2.1.1 Mission Receipt from Higher Cmd	**3.0 COA Development**	*(No - inform Comd and loop back to 2.0)*	5.3 Comd decides if Plan is viable
2.1.2 Comd Initiates Mission Receipt	3.1 Comd has Sufficient Information to initiate COA Development?	*(Yes - proceed to 4.4)*	*(No - return to 5.1)*
2.1.3 LF Informed of Mission Receipt	*(No - return to 2.0)*	4.4 Mental Wargaming	*(Yes - proceed to 5.4)*
2.2 Commander and Staff Review Own and Higher Factors, Deductions, Assumptions, Assigned Tasks, Objectives	*(Yes - proceed to 3.2)*	4.5 Staff and Comd discuss COA viability (informal IB)	5.4 Develop Contingency Plans (Branches/Sequences)
2.3 Planning Guidance	3.2 Skeleton COA/Criteria for Success	4.6 Comd approves validated COA?	5.5 Comd and Staff Issue Orders
2.3.1 Commander Provides Initial Planning Guidance	Time Constrained?	*(No - proceed to 4.7)*	5.5.1 LF receive Orders
2.3.2 Staff Receive Initial Planning Guidance	3.2.1 Comd creates Skeleton COA/Criteria for Success	*(Yes - proceed to 4.8)*	5.6 Is there time available?
2.4 Staff Develop Information Outlined in IPG and Implied Tasks	3.2.2 Comd asks Staff to create Skeleton COA/Criteria for Success	4.7 Could COA be tweaked to be validated?	*(No - End)*
2.5 Staff Define Most Likely ECOA	3.2.2.1 Staff creates Skeleton COA	*(No - assume new COA required, return to 2.0)*	*(Yes - proceed to 5.7)*
2.6 Staff Write Draft Mission Statement	3.3 Comd Approves of COA/Criteria for Success?	*(Yes - return to 4.2)*	5.7 Comd, Staff and LF perform rehearsal wargame with Sub Units
2.7 Mission Analysis Briefing	*(No - return to 3.1)*	4.8 Send validated COA to LF	
	(Yes - proceed to 3.4)		

Figure 14: Overview of IOPP steps performed

For both teams, the highest level steps of the OPP (i.e. 1.0, 2.0, 3.0) were performed in a fairly linear fashion with some overlap between steps 1 and 2, which is consistent with previous observations (Bruyn, Rehak, Vokac & Lamoureux, 2005). The highest level IOPP steps (i.e. 1.0, 2.0, 3.0) were not performed in such a linear fashion. There was frequent revisiting of step 1.0 (Situational Awareness) throughout planning and a fair amount of iteration between steps 2 (Mission Analysis) and 3 (COA development). Specifically, the Yellow and Blue teams revisited step 1.0 nineteen and ten times, respectively. Both teams switched back and forth between steps 2 and 3 three times throughout the planning cycle. This reflected the way in which the IOPP was designed and was anticipated.

Both teams identified the Criteria For Success (CFS) at different points than defined in the IOPP. The Blue team identified the CFS earlier in the process than outlined (i.e. during presentation of the Commander's Planning Guidance or CPG) rather than at the time when the skeleton COA is developed. The Yellow team, on the other hand, identified CFS later in the process than outlined. Future investigation may be needed with respect to the most appropriate time to develop the CFS. Developing CFS is not an explicit step in the OPP so a similar observation cannot be made for the OPP.

A significant amount of repetition between mental wargaming and develop/refine COA in the IOPP. Further, it was observed that the Blue team started mental wargaming earlier in the process than defined (i.e. during mission analysis rather than COA Validation). The OPP does

not include a step for mental wargaming, however, we observed that both teams revisited the refine COA step following the staff wargame (traditional rather than mental wargaming).

The sequence of OPP and IOPP steps performed during each experimental condition is shown in Annex G. The number of steps repeated or performed out of order was calculated (for the highest (i.e. 1.0, 2.0) and second highest level (i.e. 1.1, 1.2, 1.3) steps only) for each condition. A step was considered repeated if it was performed at least twice during the planning session. Table 9 shows that, for the Blue team, the number of repeated steps was slightly higher for the IOPP than the OPP at the highest level of decomposition. At the second highest level of decomposition, we observed that the Blue team repeated steps within the OPP slightly more than the IOPP. The Yellow team, on the other hand, repeated steps within the OPP slightly more than when using the IOPP at the highest level of decomposition. At the second highest level of decomposition the Yellow team repeated steps slightly more often when using the IOPP than the OPP. It was expected that there would be more repetition when teams used the IOPP given that it was designed to be more iterative, especially with respect to revisiting SA continuously throughout the process, and the fact that Mission Analysis and COA Development were intended to be performed concurrently. However, our results did not support this.

Table 9: Number of OPP and IOPP steps repeated

	IOPP Yellow Team	IOPP Blue Team	OPP Blue Team	OPP Yellow Team
Highest Decomposition (e.g. 1.0, 2.0)	2	4	2	3
Second Highest Decomposition (e.g. 1.1, 1.2)	10	6	7	9

The amount of looping that was performed for both the OPP and IOPP was also calculated. A loop was defined as an instance in which the planning cycle, having been moving forward through the sequence of functions, went back to an earlier function in the process sequence, whether that step had previously been performed or not. Table 10 and Table 11 below show the amount of looping for the OPP and IOPP at both the highest and second highest level of decomposition. For the OPP, looping occurred most frequently on the first day between steps 1 and 2 (i.e. Initiation and Orientation) at the highest level of decomposition and repeated loops back to 1.4 (gather planning tools) and 1.6 (Commander makes initial assessment) at the second highest level. This is not surprising given that the team was required to create their own maps and other planning tools, which required a significant amount of time. However, they could not afford to delay the progress of the planning so continued through the OPP while regularly revisiting step 1.4. Likewise, the Commander took a long time to perform his initial assessment but, based on a comment by the Commander, did not want to keep the team from progressing through the planning process. Therefore, step 1.6 was frequently revisited.

Looping by teams performing the IOPP occurred most frequently among Steps 1 (situational awareness), 2 (mission analysis) and 3 (COA development) at the highest level of decomposition and repeated loops back to steps 1.3 (awareness of battlespace environment) and 1.4 (awareness of other military and civilian resources) at the second highest level. This frequent looping among

steps 1, 2 and 3 was anticipated because the IOPP mandates continuous situational awareness, and second, it was prescribed that mission analysis and COA development be performed concurrently. It does not appear that there was a practice effect for looping during the planning processes. If the teams benefited from a practice effect, then it would be expected that the team would perform less looping on day 2 than day 1 as they become more familiar with the planning exercise itself. Further, there would be a similar pattern for both the Blue and Yellow teams. The Yellow team were observed to loop more using the IOPP on day 1 than on day 2 with the OPP. However, the Blue team looped back and forth between functions of the IOPP (performed on day 2) compared to the OPP (performed on day 1). If there was a practice effect, we would not expect to see such an increase in the amount of looping. Hence, these results do not suggest the existence of a practice effect.

Table 10: Frequency of loops for OPP and IOPP

	IOPP Yellow Team	IOPP Blue Team	OPP Blue Team	OPP Yellow Team
Highest Decomposition (e.g. 1.0, 2.0)	22	19	4	3
Second Highest Decomposition (e.g. 1.1, 1.2)	26	26	13	9

Table 11: Incidence of loops for OPP and IOPP

	IOPP Yellow Team	IOPP Blue Team	OPP Blue Team	OPP Yellow Team
Highest Decomposition (e.g. 1.0, 2.0)	26.8%	31.1%	9.1%	6.5%
Second Highest Decomposition (e.g. 1.1, 1.2)	31.7%	42.6%	29.5%	19.6%

4.2.7 Number of non-mandated steps added to the planning process

Both teams added non-mandated steps to the IOPP. Given that this experiment was the first time an experienced team had applied the IOPP, steps that were skipped or added are of particular interest for further investigation. First, the Commander of the Yellow team added a progress check step to the IOPP, likely because the team was unfamiliar with the IOPP and specific time constraints were imposed on the teams. The Blue team developed a back-up or alternative COA, even though the IOPP prescribes the development of a single COA. Nonetheless the Blue team reported that they felt the need to at least have a second COA on hand that could be further developed. Comments by the participants during the AARs indicate that they experienced some discomfort with developing a single COA. Specifically, participants stated that they would require a certain level of certainty before committing to a single COA, and they felt that they did not have this level of certainty.

4.2.8 Total errors made in planning process

It was intended that observers identify errors that teams made in applying the planning processes (as opposed to errors in the planning products). However, it became apparent that observers classified errors as steps in the planning process that were skipped or abbreviated or non-mandated steps that were added to the process. This data was collected and analyzed separately and is reported in earlier sections of the report (see sections 4.2.6 and 4.2.7). As such, data collected from observers did not facilitate an analysis of the total errors made in the planning process.

4.2.9 Requests for additional information or clarification

The SME observers created the scenarios as well as the Order passed down from Higher Command and therefore had a lot of background knowledge. They also occasionally took on the role of higher commander if the teams felt that they required clarification or further information relating to the orders that were passed along to them. The content of the requests for additional information or clarification were noted by observers during the planning exercises. Teams using the OPP generally asked questions relating to assumptions, relevant factors, timings, composition of a battle group, details of the ORBAT, OPP terminology and the process of staff analysis. This may be due to the limited experience of the participants in applying the OPP. Questions relating to assumptions and details of the battlespace environment suggest that either more detail should be provided in the scenario materials and the orders from higher command, or that an SME playing the role of higher command should be present in this type of experiment.

Teams using the IOPP asked questions relating to the process itself (e.g. how to outlined a COA and details of the enemy COA), expectations for the final products, IOPP terminology, assumptions, and information about the battlespace environment. Given that this is the first exposure that both teams had to the IOPP, questions relating to the IOPP itself were expected. It may also be that the online training did not provide sufficient training in how to apply the IOPP. Similar to the OPP, questions relating to assumptions and details of the battlespace environment suggest that either more detail should be provided in the scenario materials and the orders from higher command, or that an SME playing the role of higher command should be present in this type of experiment.

4.2.10 Number of team briefings observed – both formal and informal

Observers were to collect data on the number of team briefings, both formal and informal, as well as the number of participants attending the briefings. It was observed, however, that teams worked very collaboratively, especially when using the IOPP, making it impossible to distinguish and enumerate separate briefings in a meaningful way.

4.2.11 Number of options presented to commander

The Yellow team developed and presented three friendly COAs to the Commander when using the OPP and only one friendly COA when using the IOPP. Hence, in both cases, the Yellow team developed the number of COAs prescribed by the respective planning process. In contrast, the Blue team developed and presented two COAs to the Commander when following both the OPP and IOPP. The blue team indicated that they were only able to develop two COAs when

using the OPP due to time constraints. When the team followed the IOPP, they developed one main COA as well as one back-up COA. As previously mentioned, this was likely an indication of the team's, or more likely the Commander's, lack of comfort in developing and committing to a single COA.

4.2.12 Quality of planning process and products

The SME observers rated the quality of the planning process and products. Each SME observer was assigned to a single team and was therefore able to observe the application of both the OPP and the IOPP by the same team. SME observers rated the quality of the following steps in the planning process:

- Mission analysis;
- Commander's guidance;
- Staff analysis; and
- COA Evaluation/Validation.

They also rated the overall efficiency of team in applying the planning process.

SME observers also rated the quality of the following planning products:

- General working documents;
- Selected COA;
- CONOP;
- Plan; and
- Order.

Figure 15 to Figure 17 show the SME ratings of the planning process and products for both the OPP and IOPP. Figure 15 and Figure 16 show the results for individual SME observers, whereas Figure 17 shows the overall ratings averaged across observers. A five-point rating scale was used where 0 represented 'poor' and 5 represented 'exceptional'. It is important to note that, for the Yellow team, the SME observer considered the CONOP equivalent to the Plan and therefore did not rate the quality of the CONOP separately from that of the plan.

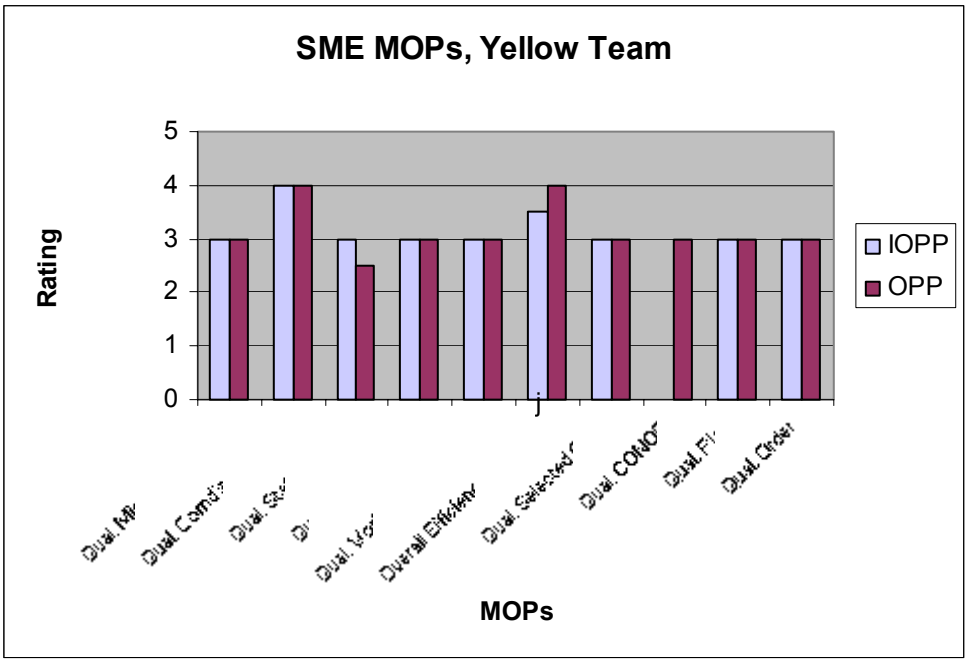

Figure 15 : Yellow Team SME ratings of planning process and products

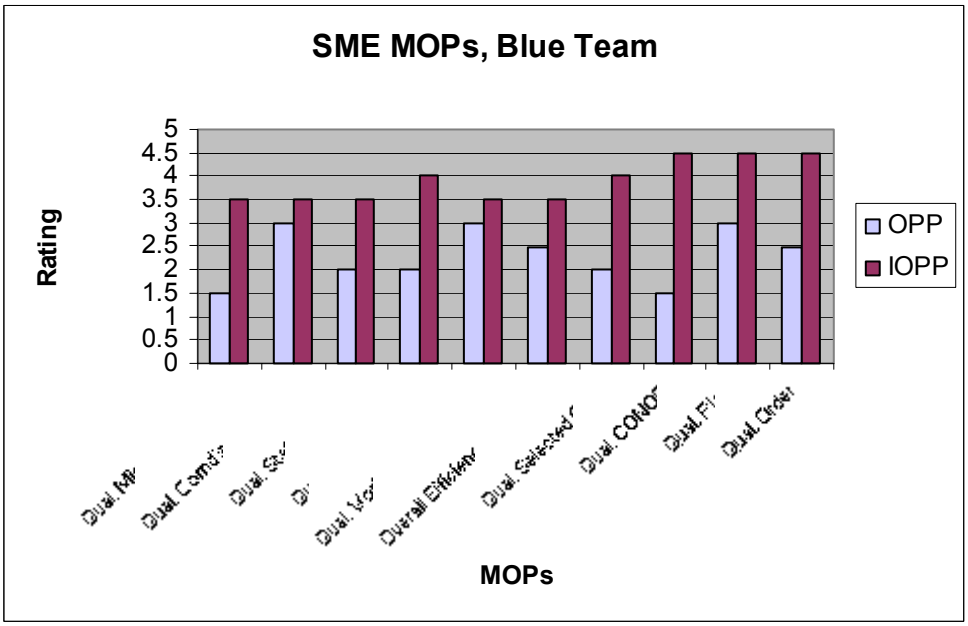

Figure 16 : Blue Team SME ratings of planning process and products

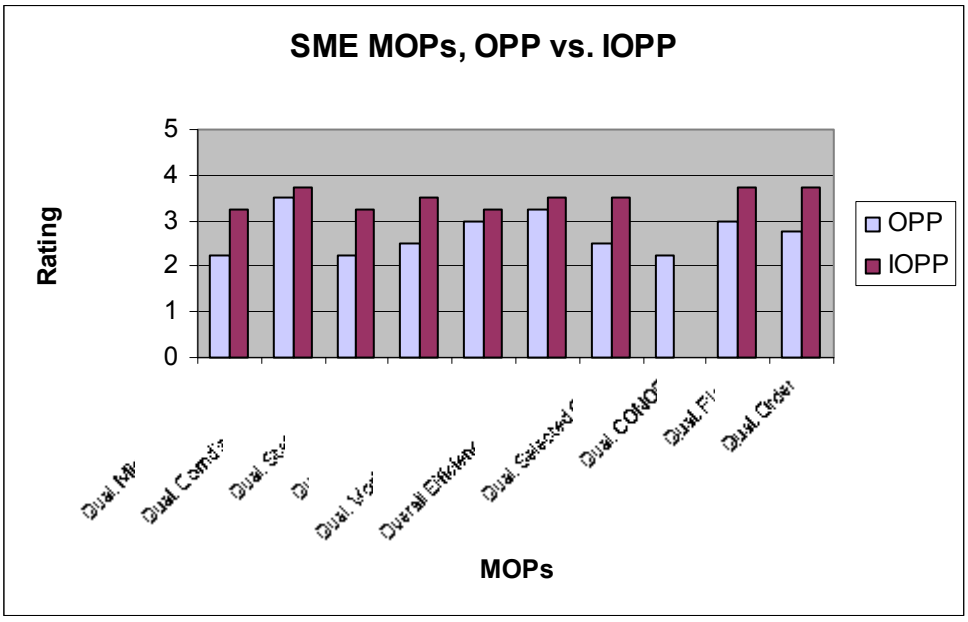

Figure 17 : Combined SME ratings of planning process and products

The SME observer of the yellow team generally rated the quality of IOPP planning process and products equivalent to those of the OPP, with the exception of the Staff Analysis process, which was reportedly of higher quality when the IOPP was used, the overall efficiency of the team, which was reportedly higher when the OPP was used, and the quality of the CONOP. The CONOP produced using the IOPP was considered equivalent to the Plan and was therefore not rated separately. The SME observer of the blue team, in contrast, consistently rated the quality of the planning process and all planning products higher for the IOPP than the OPP.

4.2.13 Usability of planning processes

Annex H includes the individual participant ratings of the ease of use, learnability, efficiency, effectiveness, complexity, suitability and overall user satisfaction for both the OPP and IOPP. Ratings for both teams were combined to calculate mean, minimum, maximum and standard deviation scores for all usability measures (Table 12).

Table 12: Participant usability ratings of OPP and IOPP

Usability of Planning Process		Max	Min	Mean	Std. Dev	Mean + 1SD	Mean - 1SD
	IOPP	4.50	2.50	3.73	0.83	4.56	2.91
Ease of use	OPP	3.00	2.50	2.70	0.27	2.97	2.43
	IOPP	4.00	2.50	3.65	0.68	4.33	2.97
Learnability	OPP	3.50	2.00	2.80	0.64	3.44	2.16
	IOPP	4.50	4.00	4.10	0.20	4.30	3.90
Efficiency	OPP	4.00	2.00	3.30	0.87	4.17	2.43
	IOPP	4.50	3.00	3.72	0.63	4.35	3.08
Effectiveness	OPP	4.00	3.00	3.50	0.55	4.05	2.95

	IOPP	4.50	2.00	3.55	0.93	4.48	2.62	
Complexity	OPP	3.00	2.00	2.20	0.45	2.65	1.75	
	IOPP	4.50	2.00	3.77	0.98	4.75	2.78	
Suitability	OPP	4.50	2.00	3.40	1.03	4.43	2.37	
Overall user satisfaction	IOPP	5.00	4.00	4.18	0.41	4.59	3.78	
	OPP	5.00	2.00	3.50	1.24	4.74	2.26	

On average, the IOPP scored higher than the OPP with respect to ease of use, learnability, efficiency, effectiveness, complexity (i.e. the IOPP was less complex), suitability and overall user satisfaction.

4.2.14 User trust and reliability of planning processes

Participants rated their level of trust in the OPP and IOPP to create a quality Plan. Given that user trust is often related to reliability, participants were also asked to rate the reliability of Plans created by the OPP and IOPP to accomplish the mission. In other words, we asked participants to rate how reliable they think the OPP and IOPP are in generating successful Plans that will accomplish the mission. Research suggests that reliability is only one factor affecting one's trust in a person or system (Adams, Bruyn, Houde & Angelopolous, 2003) and therefore separate measures of trust and reliability were included.

Individual participant ratings of trust and reliability of the OPP and IOPP to create a quality plan are shown in Annex H. Table 13 shows the mean user trust and reliability rating across participants, as well as the minimum and maximum ratings and standard deviations. Results suggest that the participants placed a slightly higher level of trust in the OPP than the IOPP to create a good plan. Likewise, participants rated the OPP as more reliable than the IOPP in terms of creating a good plan. This is not surprising given that, prior to this experiment, none of the participants had any experience, either in training or in operations, with the IOPP and therefore had no perception of its reliability.

Table 13: User trust and reliability of OPP and IOPP

Trust and Reliability of Planning Process		Max	Min	Mean	Std. Dev	Mean + 1SD	Mean - 1SD
	IOPP	5.00	2.50	3.70	0.84	4.54	2.86
User trust/confidence	OPP	4.50	3.00	3.90	0.72	4.62	3.18
	IOPP	4.50	2.75	3.68	0.70	4.37	2.98
Reliability	OPP	4.50	3.50	4.10	0.42	4.52	3.68

4.2.15 User trust and reliability in planning products

In each session, participants rated their level of trust in the overall plan, to accomplish the mission. As noted above, reliability is often related to user trust so participants also rated the reliability of the plans (created by both the OPP and IOPP) to accomplish the mission.

Individual participant ratings of trust and reliability of plans created by both the OPP and IOPP to successfully complete the mission are shown in Annex H. Table 14 shows the mean rating

across participants, as well as the minimum and maximum ratings and standard deviations. Results suggest that the participants placed a slightly higher level of trust in plans created using the OPP rather than the IOPP in terms of accomplishing the mission. Likewise, participants rated plans created using the OPP more reliable in terms of accomplishing the mission, compared to plans created using the IOPP. This is not surprising given that, prior to this experiment, none of the participants had any experience, either in training or in operations, with the IOPP and therefore had no perception of its reliability in terms of creating plans that accomplish the mission.

Table 14: User trust and reliability of planning products

Trust and Reliability in Planning Products		Max	Min	Mean	Std. Dev	Mean + 1SD	Mean - 1SD
User trust/confidence in Plan	IOPP	5.00	3.50	4.07	0.63	4.70	3.43
	OPP	4.50	3.00	3.80	0.63	4.43	3.17
	IOPP	5.00	3.50	4.08	0.52	4.60	3.56
	OPP	4.50	3.00	4.00	0.64	4.64	3.36
Reliability of Plan	OPP	4.50	3.00	3.90	0.58	4.48	3.32

4.2.16 Accuracy and overall quality of Plan created by OPP and IOPP

For both OPP and IOPP conditions, participants rated the accuracy of the overall plan in completing the mission as well as the overall quality of the plan. The accuracy of the plan in completing the mission can be defined as how precise the plan is in addressing the mission. On the other hand, the overall quality of the plan may include additional considerations such as how easily it can be understood by subordinate commanders. Participants' ratings of accuracy and overall quality of the plan are shown in Annex H. Table 15 shows the mean rating across participants, as well as the minimum and maximum ratings and standard deviations. The participants generally rated the accuracy of the overall plans created with the OPP and IOPP as equivalent. The average rating of the overall quality of the plan was slightly higher when the plan was created using the IOPP compared to the OPP.

Table 15: Accuracy and overall quality of Plan

Accuracy and Overall Quality of Plan		Max	Min	Mean	Std. Dev	Mean + 1SD	Mean - 1SD
Accuracy of Plan	IOPP	4.50	3.00	3.82	0.58	4.40	3.24
	OPP	4.50	3.00	3.90	0.58	4.48	3.32
Overall quality of Plan	IOPP	4.00	3.00	3.63	0.53	4.17	3.10
	OPP	4.50	2.50	3.60	0.87	4.47	2.73

4.2.17 Accuracy of planning process

Participants rated the OPP and IOPP in terms of their potential to lead to errors and the potential criticality of errors that might result. Again, individual participant ratings are provided in Annex H. Table 16 shows the mean rating across participants, as well as the minimum and maximum

ratings and standard deviations. In this case, a rating of 1 represented a very low potential to lead to errors, whereas a rating of 5 represented a very high potential to lead to errors. Participants rated the IOPP as having slightly more potential to lead to errors in the overall plan compared to the OPP. Likewise, they rated the IOPP as being slightly more likely to lead to a plan that contains critical errors than the OPP.

Table 16: Ratings of potential of planning processes to lead to errors in Plan and criticality of errors

Accuracy of Planning Process		Max	Min	Mean	Std. Dev	Mean + 1SD	Mean - 1SD
Potential to lead to errors	IOPP	4.00	2.00	3.35	0.87	4.22	2.48
	OPP	4.00	2.00	3.40	0.89	4.29	2.51
Potential criticality of errors	IOPP	4.00	2.00	3.15	0.78	3.93	2.37
	OPP	4.00	2.50	3.40	0.72	4.12	2.68

4.2.18 Operational effectiveness of planning process

Participants were asked to rate the operational effectiveness (i.e. the suitability of the process in a variety of operational contexts) of both the OPP and IOPP. Participants also rated how well their team followed each process during the experiment as a secondary measure of operational effectiveness. Individual participant ratings are provided in Annex H. Table 17 shows the mean rating across participants, as well as the minimum and maximum ratings and standard deviations. Results suggest that they found the IOPP slightly more suitable in a variety of operational contexts compared to the OPP. However, the participants reported that the team was better at following the OPP compared to the IOPP during the experiment. Given that the teams are more familiar with the OPP, it is not surprising that they felt that they were more able to follow the process compared to the IOPP.

Table 17: Operational effectiveness of OPP and IOPP

Operational Effectiveness of Planning Process		Max	Min	Mean	Std. Dev	Mean + 1SD	Mean - 1SD
Suitability in a variety of operational contexts	IOPP	5.00	2.50	3.72	0.89	4.61	2.82
	OPP	5.00	2.50	3.60	0.99	4.59	2.61
Team followed process	IOPP	4.00	3.50	3.75	0.27	4.02	3.48
	OPP	4.50	3.00	3.90	0.58	4.48	3.32

4.2.19 Workload ratings

Participants completed the NASA TLX workload measure twice for each experimental condition; halfway through the day and at the end of the day. Individual participant workload ratings for both planning processes are provided in Annex I. Figure 18 shows the average workload rating for each team using the OPP and IOPP. Both teams reported higher workload levels on the first day compared to the second day of the exercise. For the Blue team, this

meant that lower workload was associated with the IOPP than OPP, whereas for the Yellow team lower workload levels were associated with the OPP than IOPP. This trend is most likely the result of a learning effect as both teams became more accustomed to the planning exercise over the course of the experimental exercise. Comments of the Yellow team during the AAR at the end of the first day support this interpretation. The team expressed the opinion that they spent too much time familiarizing themselves with the scenario before they started planning because they were not familiar with things such as the battlespace. Therefore they spent a lot of time studying the map and orienting themselves. In addition, the Commander of the Yellow team commented that he thought he "only hit 1/3 of the [IOPP} steps" and felt the team spent too much time in mission analysis.

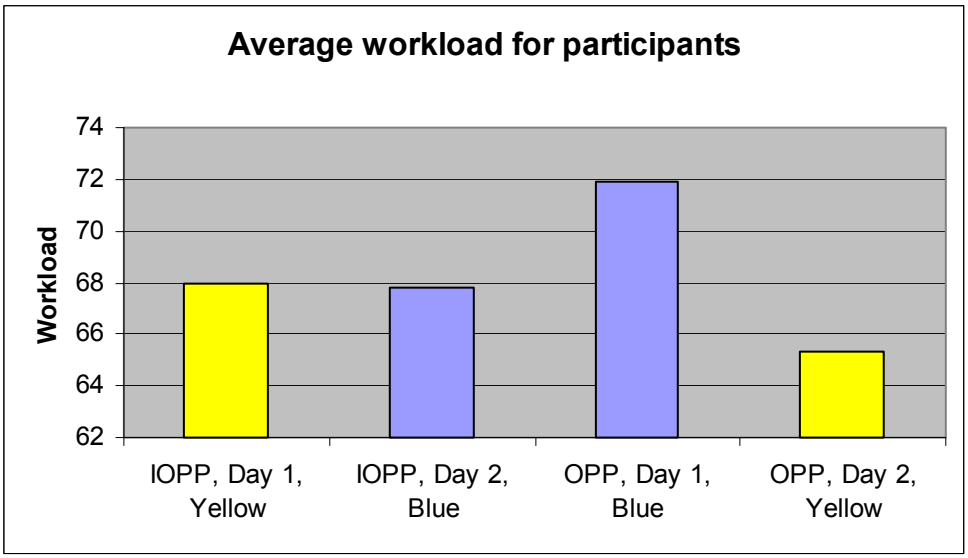

Figure 18 : Overall workload levels for both teams using the OPP and IOPP

Figure 19 shows the overall workload ratings, collapsed across teams, for the OPP and IOPP. The graph shows that the average workload rating was only slightly lower when teams used the IOPP compared to the OPP.

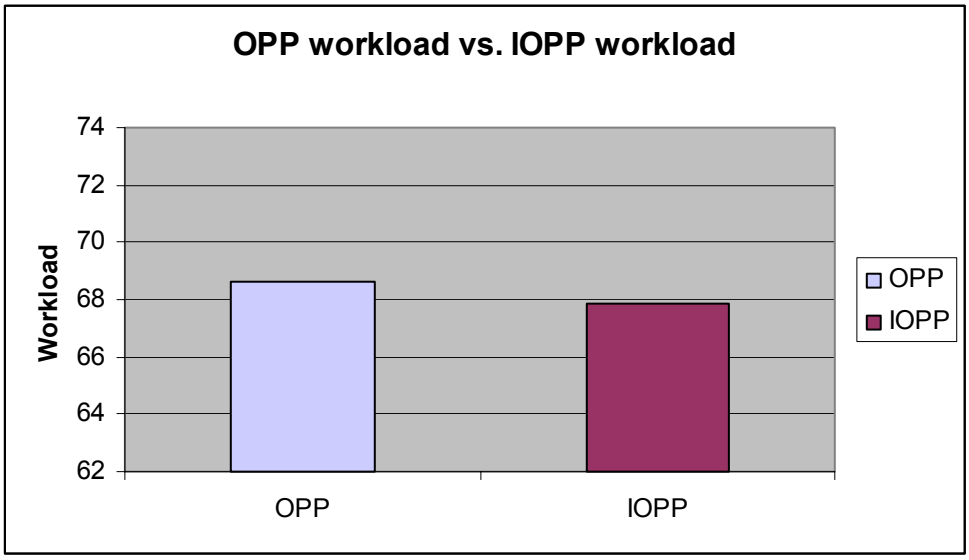

Figure 19 : Overall workload rating for OPP and IOPP

Figure 20 shows that the average workload was higher at the end of the day than the middle of the day. This is not surprising given that teams were able to adjust their schedule, or "battle rhythm," earlier in the day but faced a "hard" deadline at the end of the day for the presentation of orders. Their perceived workload likely increased toward as teams worked to meet this deadline.

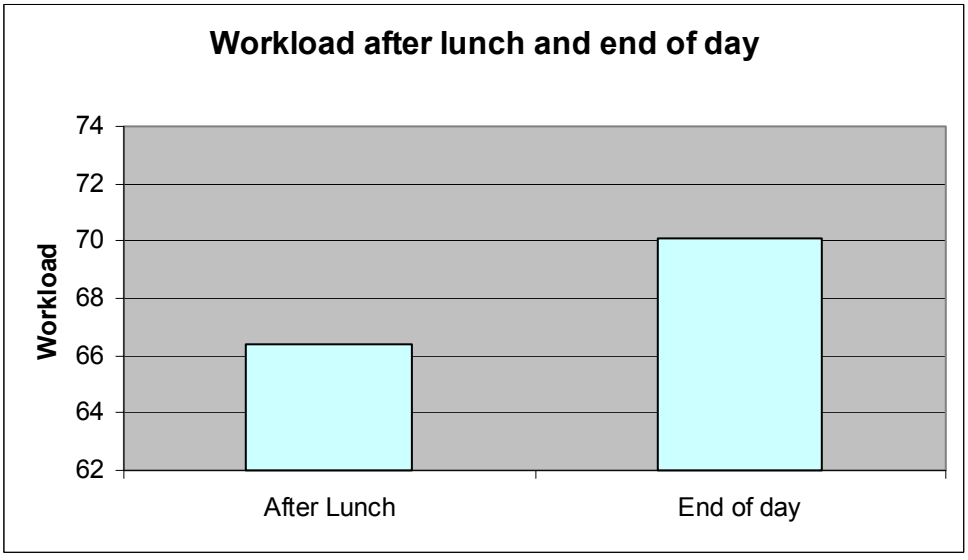

Figure 20 : Overall workload measure after lunch and at the end of the day

4.2.20 Other relevant observations

Many of the observations below came from SME or observer notes during the planning exercise as well as the outcome of the daily AARs.

4.2.20.1 Collaboration

In general, significantly more collaboration between the Commander and his staff occured when the team used the IOPP than the OPP. This was especially evident for the blue team. They organized their planning room in a more centralized fashion on the second day when the IOPP was applied. Specifically, all of their working products were in common areas, there was a common area in which the team collaborated and held briefings, and they engaged in more collaboration when setting the battle rhythm.

Both teams performed several of the IOPP steps together as a group. For example, the skeleton COA, while conceived by the Commander, was developed collectively by Commander and Staff. In contrast. when following the OPP, the teams tended to perform steps more independently. In the AARs, participants also noted that the IOPP worked well because errors were spotted immediately because of more collaboration and more effective communication.

4.2.20.2 Shared mental models

During the AARs participants noted that they were surprised how much the team was "on the same page" when using the IOPP. In fact, the blue team estimated that the Commander and Staff were on the same page for 95% of the time. Participants also liked that the IOPP encourages conversation and brainstorming through constant wargaming.

4.2.20.3 Commander involvement

Participants suggested that the personality of the Commander would play a role with the IOPP more so than with the OPP. Although participants did not provide further detail on why the Commander's personality would play more of a role with the IOPP, it is suspected that it is because the identification of a single COA is based on the experience of the Commander. The Commander on the Yellow team liked that he had the ability to identify a COA early on rather than the staff developing three COA from which he would select one.

4.2.20.4 Training

During in the AARs participants emphasized that people should be familiar with OPP before learning the IOPP. The Commander of the Yellow team stated that if adopted by CF, he "sees a potential problem with people who will only learn the IOPP". Although he does think the IOPP would work well for those that are fully trained in the OPP.

4.2.20.5 Situational Awareness

Both teams recommended a list of "bullet-proof questions" for each element of SA (especially the meta-cognitive check). They felt that SA and its application were too loosely defined in the current IOPP. Furthermore, the term meta-cognitive was not popular with the participants. Both teams liked the idea of a met-cognitive check but indicated that they would prefer different terminology.

Both teams noted that the static scenarios used for this experiment did not rigorously test their capability to maintain situational awareness. Given that things were not changing in the operational environment, there was no new incoming information on own or enemy situation, which dramatically limited the requirements for maintaining SA.

Again, both teams also felt that someone in the staff should be in charge of situational awareness, ensuring that it is performed regularly throughout the planning process. One team also suggested a sixth component of situational awareness, namely a check of whether the COA/Plan has been tweaked.

4.2.20.6 Applicability at Battle Group level

Both teams expressed the opinion that the IOPP may be more appropriate at Brigade/Division level, as opposed to the battle group level. This is somewhat surprising in that time scales are longer and resources are more abundant at higher levels and that a planning process based on intuitive decision making is likely to be more advantageous at a level where time and resources are scarce (Bruyn et al., 2005). Furthermore, one of the SMEs found it odd that the participants would suggest that applicability of the IOPP exists at the Brigade or Division level when the complexity of problems typically faced at the Brigade level and higher tend to require a more formal process.

4.2.20.7 Application of the OPP

To a lesser degree, participants had some comments regarding the application of the OPP in an operational environment. First, it was noted that a planning staff will typically skip or abbreviate steps in the OPP as time pressure increases. For example, the staff may develop two rather than three own COAs or they may only consider the most likely ECOA as opposed to the most likely and most dangerous. This is consistent with observations made in previous studies (Bruyn et al., 2005).

4.2.20.8 Benefits and limitations of the IOPP

During the AAR at the end of the second day, both teams were asked to discuss both the benefits and limitations of the IOPP. The teams noted the following benefits of the IOPP relative to the OPP:

- Lower formations play a part earlier in the process;
- There is more collaboration between the Commander and Staff;
- The process is more efficient, which is especially good for crisis planning;
- There is more time to devote to detail of COA;
- Take advantage of the experience of the Commander;
- A COA is identified earlier;
- It is not too process- or product-oriented; and
- There is more frequent formal communication up and down the chain of command.

In terms of limitations of the IOPP, the teams made the following points:

- There is a risk of committing to a bad COA too soon;
- It is not a "good process for the socially inept or intellectually weak because it uses instinct";
- It requires a strong leader to control discussions;

- Personality issues with the Commander may become an issue;
- A process involving a lot of brainstorming isn't typical in the military and may be difficult to adopt;
- There are fewer "benchmarks" on the way to the Plan;
- It is unclear how well the IOPP will work in asymmetric environment;
- The process relies on intellect and experience of people involved;
- There is too much pressure to focus on situational awareness, which makes it easier to get off track; and
- The process requires discipline to focus on situational awareness.

The number of benefits identified by participants is encouraging and certainly supports future iterations and evaluation of the current IOPP. Many of the limitations could be accounted for by the participants' lack of familiarity and therefore level of comfort with the IOPP. However, other limitations, such as the existence of fewer benchmarks or the applicability of the IOPP in an asymmetric environment, represent opportunities for improvements in the IOPP and should be considered in future work.

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5. Conclusions and recommendations

5.1 IOPP Model

The first iteration of the IOPP model exhibits the 'best' characteristics of other intuitive planning models and also incorporates findings from previous work investigating application of the OPP in the CF (Bruyn et al., 2005). The key characteristics of the IOPP are:

- The development of only 1 COA at a time;
- Mental wargaming as opposed to traditional wargaming;
- Continuous situational awareness throughout the process;
- Feedback loops from COA development, COA validation and Plan Development to the beginning of Mission Analysis;
- The concurrent performance of Mission Analysis and COA Development;
- The continuous reciprocal input and feedback from SA to every other high level function in the IOPP;
- Early and frequent communication with lower formations; and
- A time scale across the bottom to show functions against the progression of time, with the proportions of each step representing the approximate amount of time that it is anticipated that a planning team will spend on each step.

The IOPP improves on existing intuitive models of planning by including SA checks and iterative cycles. The recurring SA checks and iteration between mission analysis and COA development appears to represent a closer match to the way in which planning that is performed by CF planning staffs at the Bde level (Bruyn et al., 2005).

Although the IOPP has many characteristics that differ from the OPP, a conscious effort was made to maintain much of the same terminology (e.g. Comd's intent, wargaming, mission analysis, COA development) as well as some of the outputs generated (e.g. mission statement), planning tools (e.g. tasking matrix), and formal staff briefings (e.g. mission brief). The intention was to promote a high level of acceptance and face validity of the IOPP.

The experimental evaluation represented the first application of the IOPP in a simulated operational context. In general, the results suggest that teams of experienced LF personnel were able to follow the IOPP without much difficulty, although some participants were somewhat reluctant to commit to a single COA, likely because they are accustomed to developing three COAs (ideally) with the OPP.

5.2 Training

A web-based training course for both the OPP and IOPP was developed to allow greater flexibility in the delivery of the training than lecture-based training. Aside from some minor technological complications, delivery of the training courses was successful and, overall, participants provided positive feedback on the content and format of both the OPP and IOPP training. They did suggest, however, that the web-based training should be supplemented by some form of face-to-face training, such as lecture-based or syndicate group work training.

Participants were most dissatisfied with the lack of opportunity to ask questions at any time during the training. This would be addressed by incorporating some form of face-to-face interaction into the training.

Participant feedback suggests that incorporating more concrete examples of how to apply the IOPP and what products should be generated would have made the training more effective. In fact, one team suggested the use of JPEG or MPEG files showing specific planning products either being produced or completed. They also indicated that additional guidance on the manner in which the SA step is carried out would be beneficial, even to the point of providing a bulleted checklist of SA items to consider.

5.3 Experimental Evaluation of IOPP

Overall, the results of the experiment provided only weak evidence that the IOPP led to better planning performance than the OPP. One team (Blue) was rated consistently higher on measures of performance when using the IOPP than OPP. This result, however, must be interpreted with caution as the Blue team used the IOPP on the second day of the exercise and likely improved their performance simply from practice with the planning task. Thus, it is unclear to what extent, if any, their superior performance on day 2 can be attributed to beneficial effects of the IOPP. The other team (Yellow) showed virtually no differences in ratings of performance when using the IOPP and OPP. This team used the OPP on the second day and, if a practice effect did occur, their performance when using the OPP may have been boosted relative to their performance when using the IOPP, thereby disguising a difference between the two processes. There is, however, no way to separate the effects of process (IOPP vs. OPP) from potential practice effects.

Evidence that the IOPP works better as a process is also tenuous. Although the Blue team gave higher ratings on all measures of the quality of the process and products generated to the IOPP, the Yellow team gave essentially equal ratings for the two processes. Again, the Yellow team performed the OPP on the second day and their perception of the quality of the OPP as a process may have been higher as a result of practice with planning in general. Nevertheless, participants expressed reservations about both the IOPP and OPP, suggesting that they saw weaknesses in both.

Both teams rated the usability of the IOPP higher than that of the OPP. The IOPP has fewer steps than the OPP and both teams were able to complete a higher proportion of those steps. The IOPP also seemed to facilitate iteration, or looping, of steps during planning. Despite judging the IOPP as more usable, participants' ratings did not indicate any difference in their perceived workload between the IOPP and OPP conditions. Rather, the main factors governing perceived workload were the session day (1st or 2nd) and the time of day (morning or afternoon). Participants also generally indicated roughly equal levels of trust in the IOPP and OPP, but expressed concern that the IOPP could lead to more, and more serious errors.

On the basis of this experiment, it appears that the IOPP may be able to provide benefits to operational planning in terms of both efficiency and effectiveness. This potential, however, must be further examined and the IOPP revised in light of the feedback received from participants and external reviewers of the process. Subsequent iterations of the IOPP will address participants' concerns regarding the potential for serious errors being made in planning and consider ways to enhance the effectiveness of the process in generating creative and high-quality planning results.

It must be noted that, although generally successful, the experiment was subject to several limitations. The participants lacked experience with the OPP and had also never worked together as a team at the battle group level. Additionally, given the context of the experiment, there was a certain lack of realism inherent in the study. A battle group, for example, would have access to more resources than did the experimental teams, such as engineering, artillery, and such. In addition, the absence of outside demands allowed the Commander to be more heavily involved in the planning process than would be possible in an operational context. Data collection was also limited by the fact that that some steps in both the IOPP and OPP were implicit and therefore difficult to identify. This was especially apparent for SA steps within the IOPP. Difficulty in identifying steps was noted in previous studies (Bruyn et al., 2005) and emphasizes the need for observers to be well versed in the planning process being observed. Finally, there was an apparent practice effect over the two-day experiment, with participants having an easier time performing the planning scenario on the second day regardless of which process was used.

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6. Future Work

There is considerable opportunity for future work with regards to the IOPP model, training of the IOPP and future experimental evaluations.

In terms of the IOPP model, further development of the model should be pursued. Publication and communication of the IOPP to a broader audience is essential to successful development of further iterations of the IOPP. In communicating the IOPP to a broader audience, the fact that the IOPP incorporates the 'best' bits of existing intuitive models and incorporates continuous SA check and iterative mission analysis and COA development, should be emphasized.

Future research should specifically address criteria for success and SA in general in terms of how these concepts should best be implemented and represented in the planning process.

Several opportunities exist for training enhancements including the development of the SA component of training, improved online capabilities of the training, the provision of 24/7 support, online conferencing with audio and visual capabilities, the use of virtual syndicates, and the use of more concrete examples.

Future experimental evaluations should comprise at least a 3-day exercise in order to circumvent first day familiarization. Also, the involvement of more planning teams would be desirable in order to create a totally balanced experiment. The involvement of more participants would also increase the validity and generalizability of results. A more representative training environment, such as a command post environment in a field setting at CFB Borden, Meaford, Kingston or Petawawa may also enhance the realism of the experience.

In terms of the exercise scenarios, a more dynamic scenario that better represents modern warfare, such as asymmetric warfare, would be desirable. Further, if the experiment calls for two scenarios, the scenarios should be different enough that there is no learning effect between the scenarios. That is, planning teams should have to do an equivalent amount of mission planning (especially mission analysis and building SA) for both scenarios. With respect to the presentation of scenario information, the use of jpeg files and the provision of a trace rather than a paper map would save time for the teams and allow them to allocate more time to planning. The team would also likely benefit from more detailed examples of expected output (e.g. battle matrix).

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8. List of Acronyms

AAR	After Action Review
AMPP	Abbreviated Military Planning Process
AOO	Area of Operations
AOPS O	Assistance Operations Officer
BARS	Behaviourally Anchored Rating Scales
Bde	Brigade
C2	Command and Control
CFS	Criteria for Success
Comd	Commander
CF	Canadian Forces
CFB	Canadian Forces Base
CFC	Canadian Forces College
CFOPP	Canadian Forces Operations Planning Process
CIMIC	Civil-Military Cooperation
CLFCSC	Canadian Land Force Command and Staff College
CMBG	Canadian Mechanized Brigade Group
COA	Course of Action
COO	Concept of Operations
COP	Contingency Plan
COS	Chief of Staff
Div	Division
DRDC	Defence Research and Development Canada
FOO	Fire Operations Officer
Frag O	Fragmentary Operational Order
HQ	Headquarters
Int O	Intelligence Officer
IOPP	Intuitive Operations Planning Process
ISTAR	Intelligence; Surveillance; Target Acquisition; Reconnaissance
JTF	Joint Task Force
LCol	Lieutenant Colonel
LFCA	Land Forces Central Area
LFWA	Land Forces Western Area
LOG O	Logistics Officer
MOE	Measure of Effectiveness
MOP	Measure of Performance
NDHQ	National Defence Headquarters
ORBAT	Order of Battle
OP O	Operations Order
OPP	Operations Planning Process
Ops	Operations
OPS O	Operations Office
PTA	Primary Training Audience
PUT	Planning Under Time Pressure
RA	Research Assistant
RPM	Recognitional Planning Model
SA	Scientific Authority
SME	Subject Matter Expert
SOW	Statement of Work
TF	Task Force

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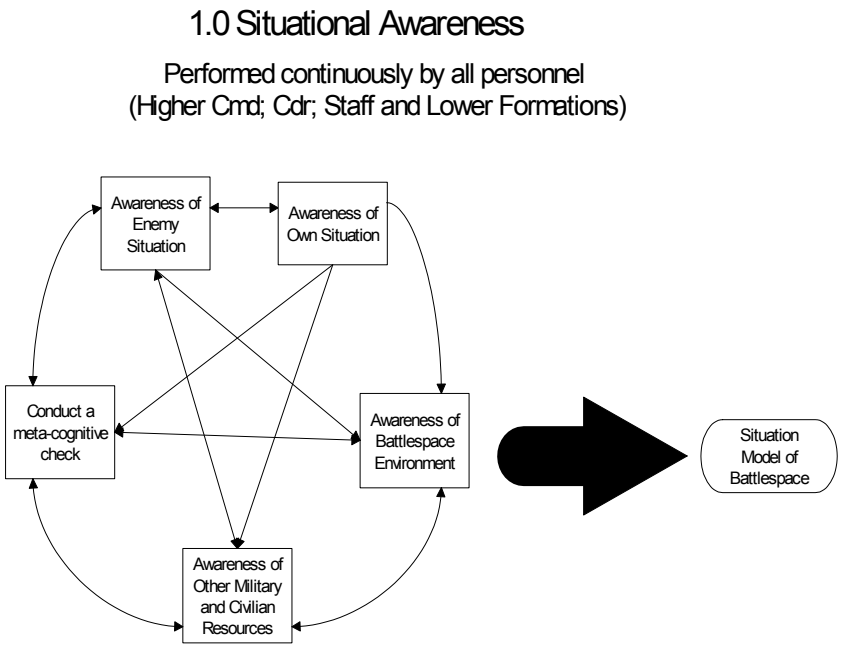
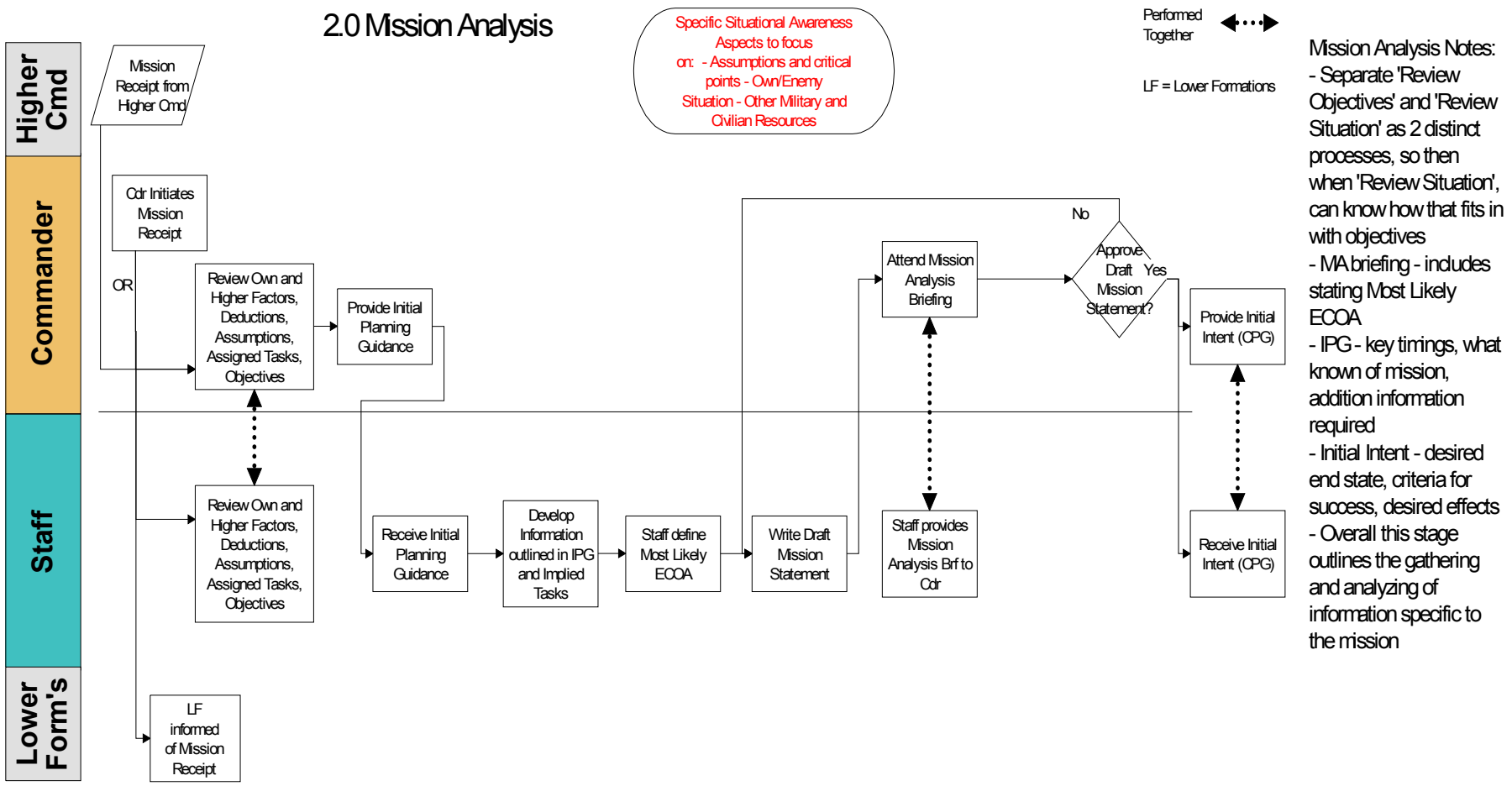
HUMANSYSTEMS
Incorporated

Annex A: IOPP Model with Training Notes

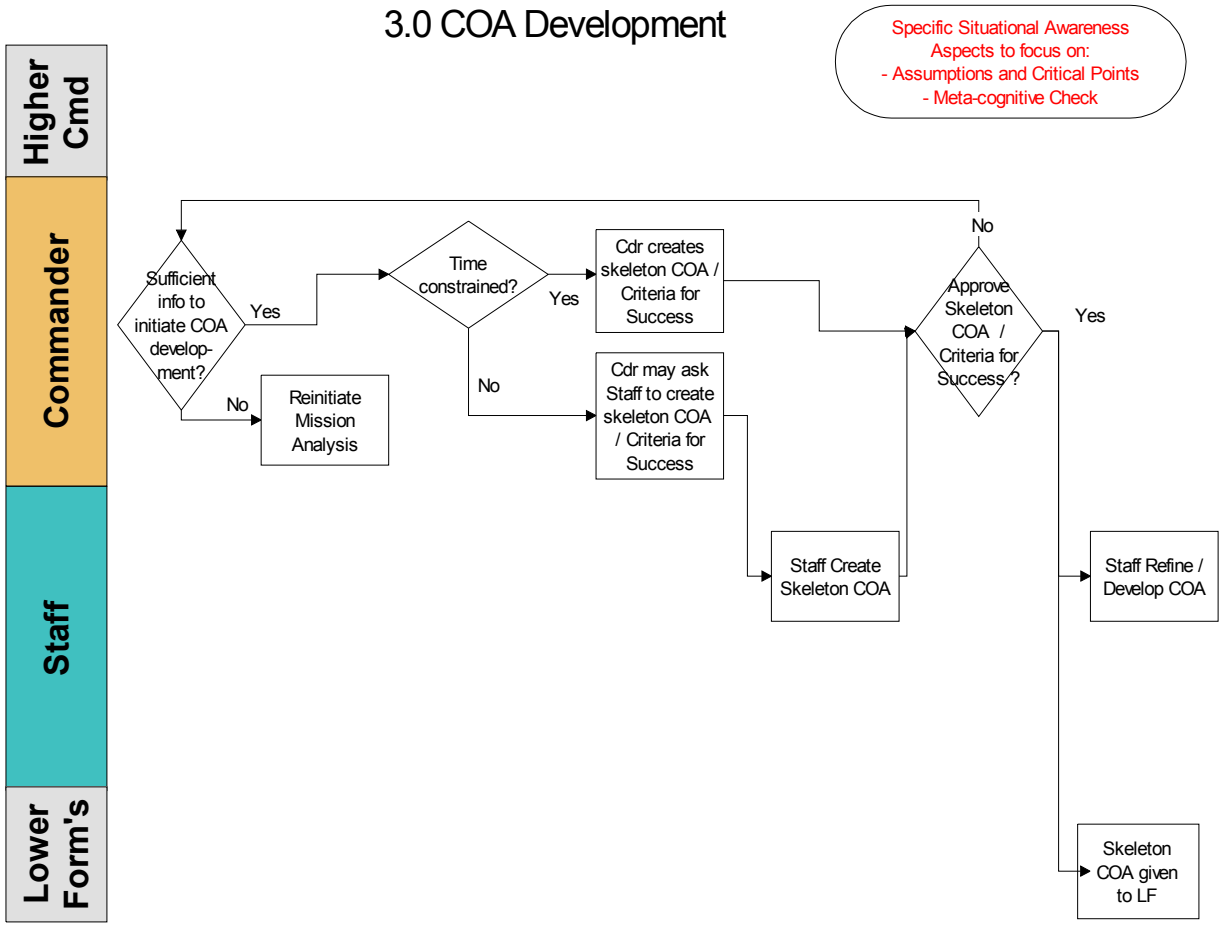


Situational Awareness Notes:
- Own/Enemy Situation - resources, constraints, opportunities
- Meta-cognitive Check (am I working in line with Cdr intent? mission? is this plan/COA still valid? Also includes noting *Assumptions and Critical Points* - these should be noted constantly by the Staff/Cdr and reviewed regularly to ensure still valid)
- Battlespace environment - geographical area, political situation, climate, terrain, cultural awareness...etc;
- Resources - NGOs; media, and other civilian organizations that share our battlespace (and could have other agenda's)
- Overall this process is meant to display that not everything is a discrete action, also reminding personnel to ask "what is happening around you?", "what does it mean?", and "how does it relate to/impact other things?"... similar to Common Operating Picture or Situation Model of Battlespace

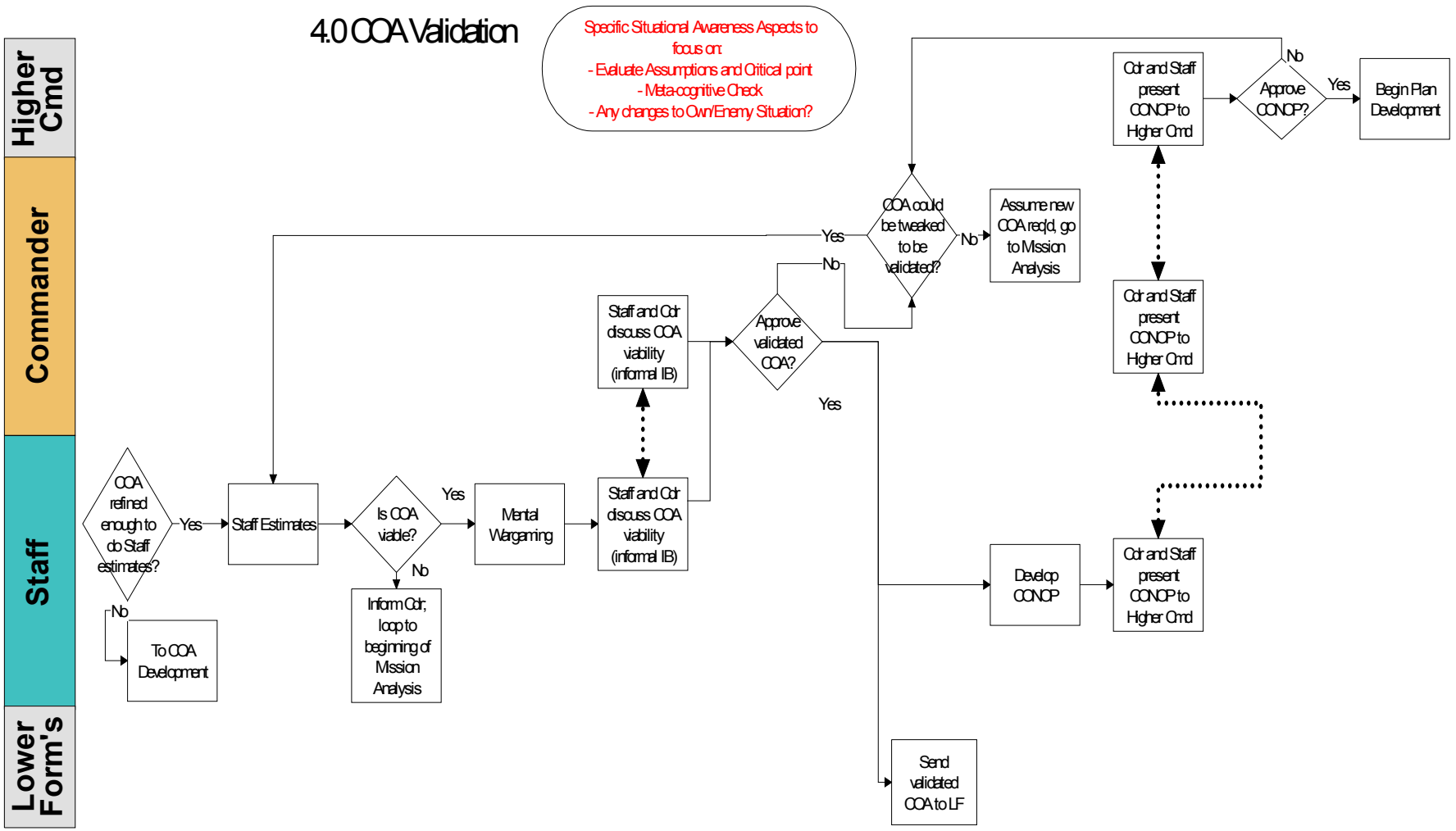
Overall Notes:
- the size of all the process boxes are the same, and are not meant to reflect the amount of time spent on each activity (i.e.. some processes take a great deal longer than others...)



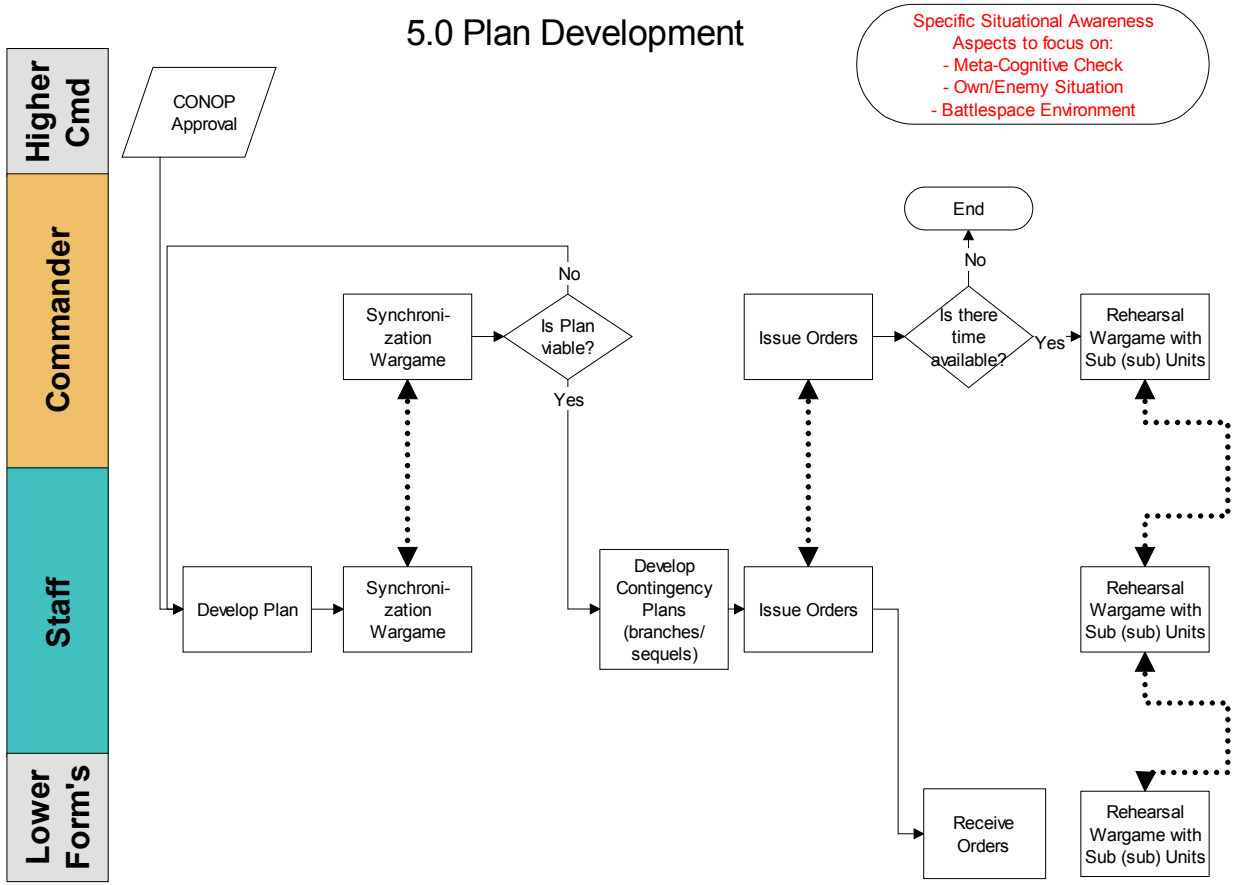
Mission Analysis Notes:
- Separate 'Review Objectives' and 'Review Situation' as 2 distinct processes, so then when 'Review Situation', can know how that fits in with objectives
- MA briefing - includes stating Most Likely ECOA
- IPG - key timings, what known of mission, addition information required
- Initial Intent - desired end state, criteria for success, desired effects
- Overall this stage outlines the gathering and analyzing of information specific to the mission



COA Development Notes:
- Staff Refine / Develop COA - identify taskings and groupings, C2 structure, develop initial battlespace graphics, initial tactical objectives; develop COA by adding pieces and make more robust. Need to note *assumptions, critical points* and identify initial *branches and sequels*.
- Overall, this stage occurs as part of Mission Analysis - is separated out to visually (in the diagram) show the growth of the COA from the beginning


4.0 COA Validation
Specific Situational Awareness Aspects to focus on:
- Evaluate Assumptions and Critical point
- Meta-cognitive Check
- Any changes to Own/Enemy Situation?
Higher Cmd
Commander
Staff
Lower Form's
COA refined enough to do Staff estimates?
Yes
No
To COA Development
Staff Estimates
Is COA viable?
Yes
No
Inform Cdr, loop to beginning of Mission Analysis
Mental Wargaming
Staff and Cdr discuss COA viability (informal IB)
Staff and Cdr discuss COA viability (informal IB)
Approve validated COA?
Yes
No
COA could be tweaked to be validated?
Yes
No
Assume new COA reqd, go to Mission Analysis
Develop CONCP
Cdr and Staff present CONCP to Higher Cmd
Cdr and Staff present CONCP to Higher Cmd
Cdr and Staff present CONCP to Higher Cmd
Approve CONCP?
No
Yes
Begin Plan Development
Send validated COA to LF

COA Validation Notes:
- Staff Estimate is the same process outlined in the current OPP
- Viability encompasses: suitability, feasibility, acceptability, and completeness
- mental Wargaming (most dangerous ECOA, branches and sequels, assumptions, critical events, decision points, inconsistencies, decide whether it meets criteria for success). This 'mental wargaming' process is less formal and more reflective than what 'wargaming' currently is. Attention must be paid to assumptions and critical points in mental wargaming (and throughout dev'mt/validation process).
- during Staff and Cdr discuss COA - work out final issues, agree it seems viable (at end of approval COA developed as a CONOP)
- Overall this stage involves a great deal of questioning of the viability of the COA... if the COA is not validated then a new COA needs to be started



Plan Development Notes:
- intentionally left out create Orders, leaves open the choice of how to deliver Orders (verbal, written, etc)
- Plan should be expressed in terms of initial state, desired end state and transition state

Annex B: Participant Ratings of Online Training

Question	P1	P2	P3	P4	P5	P6	P7	Mean	Min	Max	Std
The way the lessons were presented	3	2	5	5	4	4	4	**3.9**	**2**	**5**	**1.07**
The use of example	2	2	2	4	3	4	2	**2.7**	**2**	**4**	**0.95**
The use of graphics	4	3	4	4	4	4	3	**3.7**	**3**	**4**	**0.49**
The web-based delivery of the training	3	4	5	5	5	2	0	**3.4**	**0**	**5**	**1.90**
The convenience of the training	5	4	5	5	5	4	5	**4.7**	**4**	**5**	**0.49**
The overall effectiveness of the training with respect to your retention of what was taught	2	4	4	4	4	3	3	**3.4**	**2**	**4**	**0.79**
The feedback provided by the training application	2	4	4	4	3	2	1	**2.9**	**1**	**4**	**1.21**
The speed of the system	5	4	4	4	3	3	2	**3.6**	**2**	**5**	**0.98**
The opportunity to ask questions/get support from course facilitators	2	2	3	3	2	1	1	**2.0**	**1**	**3**	**0.82**
The information imparted during the training	3	4	4	5	4	4	4	**4.0**	**3**	**5**	**0.58**
The relevance of the training to your role	5	4	5	4	3	5	4	**4.3**	**3**	**5**	**0.76**
The value of the training to the Canadian Forces	2	4	5	4	3	4	4	**3.7**	**2**	**5**	**0.95**

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Annex C: Observer Observations

OPP Blue Team

Time	Observations
0:00	Comd takes ~5min to organize team and give initial direction.
0:01	Team general organization of materials
0:11	Comd gives instruction and responsibilities
0:11	Cmdr checks in with staff to see if they have the necessary tools
0:11	Comd says to start initiation process - think about factors and constraints
0:11	IO to focus on E COAs after - most likely most dangerous bridgeheads
0:11	Comd going to do IPG
0:12	Comd goes to do initial planning guidance (physically left the room)
0:12	Cmdr leaves to develop planning
0:14	IO investigates enemy positions
	IO is reading Intel summary
	OPS O sorting out cheat sheets do doest forget steps, grouping papers
0:15	AOPS O putting overlay on talc
0:15	A Ops O and logistics
0:15	IO referring to battle staff smartboard for maps, symbols, etc.
0:15	IO doing overlap for E COAs
0:16	Much tracing of maps
0:20	FOO & LOG assess ANNX A and set map
0:25	Comd still developing IPG - assumptions, CCIRs, comd intent, facts and assumptions
0:25	Looking at task organization matrix
0:25	OPS O begins to look at overlay, comparing paper to talc
0:29	Updating of maps and overlays
0:32	Comd requests help from arty (John) later in day
	IO comes to get enemy doctrine (how they attack, breakdown, order of march echelons, how they deploy) from OPS O
0:34	In a real war, IO should have this with him
0:36	LOG an AOPS O are reviewing big map
0:37	OPS O and AOPS O ask if bridges have been identified
0:38	Comd announces he will deliver IPG in 5 min
0:38	Comd announces that initial planning guide will be released
0:38	OPS O and AOPS O are mapping text to map
0:39	Comd observes OPS O and AOPS O doing above
0:40	OPS O returns to desk and interprets more info from package
0:42	OPS O and AOPS O interpreting map - ambiguity
	Comd tells people where he wants them to sit
	OPS P and AOPS O are discussing
	Everyone else is looking over notes
0:42	Comd says 'listen up'
	Comd gives intent (as outlined by higher Comd??) verbally (will also provide it on paper) and timeline
	Comd shares some of his guidelines
	Passes assumptions onto to OPS O: specifically what we have to do, CIRs to think about
	IO needs to understand enemy speed
0:42	Questions?

Time	Observations
	Plan:
	10:30 need mission analysis brief COA
	13:00 mission brief
	15:00 all products generated
	15:15 practice presentation
0:42	15:30 end
0:42	Comd tells OPS O his more specific needs - time, speed, distance of enemy
	Comd delivers IPG - asks for update from A Ops O IO (all present) for enemy update
0:44	44-56 mins
	IPG - intent, role of 4RCR, timings (48hr), mission, CCIR - tells IO need to get good
0:44	idea of how fast enemy can move
0:44	Timings for rest of day - to be posted
0:44	To present msn brief @1030 and debrief 1300, products generated 1500
0:55	Cmdr leads team meeting, asks for assumptions
0:56	OPSO assigned task of mission statement
0:57	FOO assinged task of "shaping and channelizing" the enemy
	LOG assigned task of managing the dumping stations for combat supplies, and
0:58	transfer of supplies
1:00	IO is asked to prepare a time statement of enemy speed and volume
1:02	OPSO gives IO ORBAT - calculates when they will see lead elements
1:02	OPS O gives IO ORBAT -> speed, distance, time
	LOG looking at big map with AOPS O -> routes, dump sites, movement of
1:03	humanitarian aid, ammunition, rations
1:06	FOO posts timeoutline on door reflecting guidelines
1:08	Comd meets with Ops O to do msn analysis
	Comd and OPS O: clarification and brainstorming (Comd telling OPS O what he wants said in the Mission brief because OPS O doesn't know much about Mission
1:08	Analysis
1:10	LOG confers with AOPSO
1:16	Done first map
1:17	OPS O writing out Mission Brief using Comd, map, and Frag material
1:19	Comd and IO meet - IO needs to create TALC
1:20	LOG & FOO agree on map tracing and strategy re: firelines and supplies
	OPS O and AOPS O work on mission brief together
1:24	- Using a 'mission analysis proforma' and Comd's assumptions
1:24	FOO confers with Cmdr to check enemy positions
1:25	LOG confers with Cmdr on barriers and logisitic planning
1:25	LOG confers with OPSO re: trace overlay
1:26	FOO convers with OPSO on the Mission Analysis brief
1:28	Mike sent to assist IO in developing timeline
1:28	Comd wants timeline that is rolling
1:28	IO explains 2Bde 3km east @ 75% effectiveneess
1:28	Templating enemy timeline onto talc
1:28	FOO works with IO on OPFOR time and space assumptions
	Cmdr and LOG discuss NSR, combat supplies, Adm company, resources
1:32	necessary to secure flank
1:34	Cmdr gives LOG responsibility of situating the reserves to protect the North Flank
1:36	*Note: Kent giving assumptions to 10 - helps them out with relevant factors
1:38	Cmdr receives input from SME
	OPS O asked Comd for info, was told to ask SME
1:42	OPS O talking to SME

Time	Observations
1:43	*Kent helping Ops O trying to figure out 11 hour - look @ timings in Frag O
1:45	LOG completes trace overlay
1:47	Comd asks if going to meet timing for min analysis brief - "No"
1:53	Changed timings of msn analysis brief onward
1:54	IO helper (floater) asks for Comd's help with timeline and location of enemy
1:54	Comd says MA brief in 15min (moving it in 15min increments)
1:54	IO returns with trace/overlay
1:54	FOO confers with Cmdr re: timing of guidelines to staff
1:55	Cmdr changes Mission Analysis Brief to 11:15AM
2:00	Comd says want to spend more time on MA b/c important
2:00	Ops O asks Kent for more info
2:04	Cmdr and LOG discuss North Flank defense, boundaries, and troop deployment
2:10	Picture taken of enemy location on IO overlay
2:10	Comd tells OPS O that he should call the meeting when he is ready. Meeting set for 11:20
2:12	Mission Analysis brief set to 11:20AM by OPSO
2:15	All attend mission brief statement
2:16	MA - all with Ops O leading
2:16	Log O - enemy location and kill zones for friendly
2:16	Ops O - Comd intent, implied tasks, resources (too low), mission, assumptions
2:16	Comd asks to repeat enemy assumptions
2:16	Mission Analysis brief begins
2:17	OPSO begins, LOG "christens the grounds" and explains setup
2:18	OPSO sets mission and its implied tasks
2:19	Cmdr works with assumptions
2:20	Cmdr redesigns of the mission analysis, timing assumption
2:28	Comd asks to repeat msn statement - helps craft mission statement
2:28	IO states assumptions for enemy
2:28	Comd asks how long till advance guard into kill zone? *Critical timing
2:28	Comd gives Ops O assumption re northern flank - needed for COA development
2:28	Ops O - CCIR
2:28	*Kent acts as Bde G3 - gives assumptions - won't see bridge crossing til light tomorrow, 422er will withdraw
2:28	Provided critical timings so that they can move planning along
2:28	*Kent gives hints on how to do staff analysis
2:45	
2:50	Finish msn analysis brief
2:50	Finish mission analysis
2:59	Lunch
2:59	Break for lunch, planned 30m, lasted 1 hr
3:00	Lunch 3:00:00 to 4:00:00
3:56	NASA TLX
3:56	Return from lunch, fill in NASA TLX
4:11	Comd gives CPG review - COA development, gives considerations and sets the picture
4:11	Tells OPS O: 2 Fr COA and flank
4:12	Comd gives direction for COA development - 2 friendly COAs and E most likely and most dangerous
4:12	Lists out 7 considerations for COAs
4:12	*Took picture of COA considerations
4:12	Cmdr uses talc to set up battle positions
4:16	IO works on developing OPFOR COA (most likely, most dangerous)

Time	Observations
4:18	OPSO works on developing 2x FF COAs
4:21	Comd drawing on flipchart - picture *
4:21	Ops O, IO and Mike (floater) mtg @ chart
4:21	IO reviews possible enemy actions
4:23	OPS O and IO are trying to figure out where the enemy is going
4:23	OPSO organize FOO & IO to discuss enemy COA and set barriers
4:30	AOPS O is creating matrix that will be passed on to subordinates
4:33	Comd asks IO to map most likely and most dangerous E COA on talc
4:33	Mike (floater) working on Arty Plan
4:34	Cmdr confers with LOG & FOO to discuss artillery
4:36	OPS O is aware of most likely E COA so can start to think of own COA (troops, fire)
4:38	IO drawing most likely E COA
4:38	Cmdr meet with IO privately
4:39	FOO inspects COA1 in response to OPFOR most likely COA
4:40	FOO confirms w AOP
4:42	Team called over for COA development, LOG raises question of firing range
	OPS O and Comd work on COA development
4:42	OPS O and LOG also working together
4:50	Ops O drawing COAI on top of most likely E COA (another talc)
4:50	*only doing 2 COAs for most likely E COA because of ex time
4:54	A Ops O drawing COA2 on talc (with logistics)
4:54	Ops O works more on COAI - synchronization and phasing of fires
4:54	COA 1 complete
4:55	2nd COA development: LOG, Cmdr, AOPSO, and IO
	FOO and OPS O working on details of COA 1 (synchronization, phasing, fires, timing of fires, type of fires)
	AOPS O, LOG, IO working on COA 2
	OPS O and FOO working on COA 1 -> measures to consider
	AOPS O and LOG working on COA 2 -> measures to consider
	AOPS O, LOG and FOO working on COA 2 -> measures to consider
4:56	OPS O working on COA 2 -> measures to consider
4:57	Cmdr sends FOO to work with OPSO on fireline for COA1
4:59	FOO suggests timing of fire to OPSO type
5:04	IO working on most dangerous COA on talc *took picture
5:04	LOG & AOPSO work on COA2 - pros/cons
5:06	Non-traditional but LOG is helping out working through COA considerations set
5:08	FOO & OPSO works on COA1 artillery to shape
5:09	A Ops O and log O drawing COA2 on top of most likely E COA
5:14	Comd wants Ops O to present COAI in 5 min
5:14	Comd tells OPS O to brief group in COA 1 in 5 mins
5:17	FOO updates COA2, team meeting COA development presentations
5:18	Mike (floater) doing fire plan on COAI
5:20	presents COAI
5:20	IO - most dangerous and most likely COA
5:20	Info brief!
	OPS O reports to entire group
	- IO presents most dangerous and most likely enemy COA
	- OPS O presents Fr COA 1
	- AOPS O presents friendly COA 2
	Questions and future direction from Comd throughout. What does Comd want for
5:20	decision brief
5:21	Meeting commence

Time	Observations
5:25	Ops O presents COAI
5:25	Comd gives further direction on how to develop COAI
5:25	Comd asks him to discuss how COAI address 7 COA considerations
5:25	COA1: IO and OPSO
5:30	COA1: Cmdr gives ISTAR focused feedback
5:31	Ops O presents COA2
5:31	*Note: Comd looking @ OPP process!
5:31	Comd provides more direction - need more detail for ISTAR, etc
5:34	COA2: AOPSO
5:36	Decision brief @ 6:00 ex time
5:36	Set decision brief for 6:00:00
5:38	Informal brief led by Comd…would like wargaming
5:41	AOPS O and LOG thinking through issues raised by Comd
5:42	LOG and AOPSO consider AA for COA2 synergy fire
5:42	Comd gives informal instructions for wargaming
	Comd gives wargaming outline - Formal
	- IO (enemy) and OPS O (us) -> wargame COA 1
5:43	- Io (enemy) and AOPS O (us) ->wargame COA 2
5:43	Wargaming as a team
5:44	Wargaming - IO plays enemy; Ops O plays friendly - all present
5:50	Offer a COA3
5:59	Comd wants Ops O to recommend COA and present decision brief right away
5:59	Comd asks OPS O to wrap up and give recommendation
5:59	LOG adds input
5:59	Cmdr suggests finalization
6:02	OPS O suggests modifying COA 1
6:03	Ops O decides on abbreviated COAI (A)
6:03	Comd says decision brief @ 6:10
6:03	*doing expedient comparison of COAs
	Decide on COA 1A
6:03	Decision Brief to take place at 6:10:00
6:04	Cmdr selects COA1a
6:05	AOPS O has to leave for the day
6:07	Cmdr reassigns Decision Brief to 6:10:00
6:10	Working on last details of COA 1A
6:11	Ammend COA1a
6:13	Realize that they haven't done matrix comparison
6:16	Doing matrix comparison
6:16	OPS O, IO and LOG begin matrix
6:16	Decision matrix composed for COA1, COA2, COA1a
	Decision Brief
	- ECOA presented by IO
	- OPS O and LOG present two COA (COA 1A and COA 2) followed by preferred
6:20	COA
6:22	Decision brief
6:22	IO enemy COAs
6:22	Ops O presents COAI *adv and disadvantages of each
6:22	Log O presents COA2
6:22	Ops O presents COA comparison matrix with Comd's COA considerations/criteria
6:23	Decision brief commence
	Matrix presented (both COA compared against COA considerations as outlined by
6:34	Comd)

Time	Observations
6:34	Compare COA1 & COA2 along seven considerations
6:36	Comd concludes. Staff is recommending COA 1A
6:38	Comd wants Ops O to work up COAI but wants answer for fire support issue
6:38	Comd gives authorization for COA 1A. Can get on with grouping and tasking matrix)
6:38	COA1 is authorized by commander
6:39	Told to work on grouping and tasking matrix
6:39	Grouping and tasking matrix deadline established for 6:48:00
6:42	OPS O and LOG begin tasking and grouping matrix
6:52	Ops O and A Ops O preparing taskings matrix
6:56	Comd is writing mission statement. He is preparing for plan presentation
6:57	Conops developed, approved, and plan developed and approved, and delivered in presentation
6:58	(**** all events occurred nearly simulatenously ****)
7:00	Presentation of orders!
7:00	Comd - repeats mission and mission statement
7:00	IO - present E COA - most likely and most dangerous
7:00	Comd presents COAI modified
7:00	Introduces plan for main effort
7:00	Questions?
7:00	Discuss timings
7:00	How to close off back of killing zone
7:00	Presentation of plan (SME acting as High Comd)
7:10	Done!!
7:10	OPP completed for Scenario A, Blue team
7:10	Discussion (questions to SME)
7:10	NASA TLX

IOPP Yellow Team

Time	Observation
0:00	commander asks group to take 15 minutes to read in their roles
0:02	engineer states that OPSO is different from what was explained to them
0:03	Comd tells group to take 15 min to read over scenario, familiarize with role (all are at desks reading)
0:05	engineer examines back map
0:06	eng asks for actual trace of map--commander suggests looking in folder
0:07	OPSO is highlighting and reading, EngR is looking at maps and and asking Bob about trace
0:08	all reading quietly
0:10	2 staff members examine back map and ask whether they can print stuff; they discuss and clarify state of enemy attack
0:10	OPSO comparing book map and classroom support template, then comparing book map with wall map
0:12	OPSO is joined by AOPSO at WM, adressing where objective is going, KZ locations, concerns of taskings
0:14	eng examines map
0:17	eng examines map
0:17	Bob talking with Comd about what they are trying to prevent, BG arrangment, other info in package then going to map together and discussing locations
0:18	Hill asks FOO info on one of the sheets in the folder

Time	Observation
0:19	eng examines map
0:19	OPSO and IO discussing expectations (IO asked OPSO), then discussion of constraints as going through package
0:21	Comd looking at files on CD, Orbat… trying to determine what RCR 1, 2, 3 is
0:22	eng approaches map; FOO joins eng
0:23	AOPSO joins in Bob's presentation with Comd about what is in the BG
0:25	eng tries to clarify what his role is. FOO helps him with it.
0:25	Comd and OPSO talking at WM, outlining timelines to get to skeleton COA (looking at IOPP chart), trying to determine how to capture metacog
0:27	eng asks what an ATDM is; FOO tries to help; eng asks Bob
0:27	commander, FOO and OPSO discuss IOPP by process map; Eng joins them
0:28	commander gives OPSO task
0:28	Comd rearranged room Comd recommended 15 minute reading in about situation
0:28	OPS O/AOPS O met at map 1 for 1 min and then returned to desks AOPS O queries ATG with FOO. OPS O got involved. ENG got involved
0:28	AOPS O goes to map to locate items noted in Operation Order OPS O discusses what is required, want Comd IPG
0:28	Review structure of 4CMBG, what's available
0:28	OPS O discussing IOPP with Comd and FOO
0:28	OPSO, IO, FOO, AOPSO still discussion metacog
0:29	AOPS O puts talc on map #3
0:29	ENG turns up to listen to COMD
0:31	COMD noted that SA, awareness of entire situation, current situation, civil etc. won't change, therefore meta cognitive check regularly to determine if what is being planned still makes sense.
0:31	Comd assigns OPSO to figure out how to document metacog, and ensure that it gets covered
0:32	commander asks FOO to make list of assets down to platoon and det levels
0:32	Comd wants blow up of KZ and and other areas from IO
0:32	Comd talking to FOO about what he's doing
0:33	Comd getting information needed 33-35 mins
0:38	AOPS O and ENG
0:39	eng and AOPSO(?) map out battle space; they have trouble tracing from photocopy
0:40	OPS O reviews specific items in meta cog check (Tab's laptop)
0:40	Bob talking with FOO about Orbat
0:40	IO and OPSO discussion
0:40	Comd asking about laptop usage; Comd takes a laptop, EngR takes other
0:42	ENG started laptop on Map 3 to get more detailed view of trace
0:42	Comd started laptop on counter at side of room
0:44	OPS O discussing sync matrix with IO
0:45	FOO posts asset list on side bulletin
0:45	Comd puts up ISTAR matrix, and looks over; IO talks with OPSO still
0:49	OPS O mentoring IO in what to do
0:49	Comd discussing with Bob about squadrons, who is mission and files on CD
0:49	IO, AOPSO, and EngR took look at WM
0:51	OPS O moved flipchart to beside map #1
0:54	FOO asks commander if asset list is sufficient
0:54	OPSO outines 'rhythm' of flappaper

Time	Observation
0:54	IO reading over info, noting maps of interst
0:54	Bob talking with AOPSO about what is in North, south, west…
0:54	AOPSO creates overlays
0:55	OPS O defined battle rhythm of flipchart, confirmed with Comd and will brief rest of cell at 10:00
0:55	Broken down to deliverables not steps: 10:00 Staff meta cog check and every hour as required (1.5) 12:00 CPG (2.9) 12:30 Skeleton COA issued (3.2) 13:30 Validated COA issued (4.8) 14:30 Sync War Gaming complete (5.2) 15:00 Orders complete (5.5) 15:30 Brief to Cmd (End State)
0:56	eng and FOO update asset list
0:58	Comd directs that in 2 mins will brief
0:58	Comd and IO (EN ECOA) - High Cmd asked about strength of En 3 Bde at Gananoque river
0:58	Comd - Assigned and implied tasks. CONOP?
0:59	OPSO outlines time-line to group
1:00	OPS O briefed battle rhythm AOPS O queried actual format of orders Detail of meta cog check Brief was arranged quickly and informally
1:00	Went around staff to give brief update: IO - ECOA briefed: intent is to achieve tactical surprise FOO/support arms advisor, need to develop fire plan Synch matrix H --H and 20: only has a bunch of tasks, complex set of tasks Comd cut in to focus FOO to task at hand Comd asked AOPS O to pay attention to briefing OPS O: who is responsible for CAS COMD keep team on track. Not to plan too far forward ENG briefed what can be used in KZ D1 and D2, no time and space issues, it is right there ready to be placed Comd summarizes
1:00	AOPS O shows on map how Op force will move, how own force will react, withdraw to Infers some branches and sequels Probable next phases: know about own forces, how laid out, enemy ORBAT received Tracked vehicles ENG -> implications
1:00	OPSO leading first 'formal' brief, all attending
1:00	displays battle rhythm (on flapsheet), and 'staff co-ords' (aka metacognitive checks) that will be occuring every hour
1:02	metacognitive check update
1:02	each member of teams states what they are working on
1:02	Comd comments on what each member is doing, also emphasizes the role of assumptions, and how the OPSO is documenting them throughout the process
1:03	FOO gives report on own status; FOO asks commander for time window
1:07	eng gives status report--makes 2 assumptions and 1 deduction
1:12	Comd clarifies the goals of phase 2 (phase 2 is what they are planning for), ensures that all members have a shared understanding
1:12	Comd goes through SA point by point (5 stars of SA), ensures all have SA

Time	Observation
1:12	Comd asks Bob about issues he's not clear on…
1:18	someone mentions concerns about terrorists
1:20	AOPS O: Terrain Sensor limitations Civilian, NGO etc. - not much known Terrorist Organization in Gananoque Assume no refugee corridors Comd - any other factors that anyone can suggest Any helo assets End meeting 1:20
1:20	Another trace at map #1 Comd wants another collaborative session at 10:40
1:21	OPS O -> map #1 AOPS O -> map #3
1:22	group meeting ends
1:25	IO talks with OPSO, then OPSO back to wall map, IO back to desk
1:25	all working quietly
1:30	EngR looking for App 2, which he doesn't have… Bob gives him a brief of information that he needs
1:30	Others working quietly
1:30	OPSO brings Comd over for discussion, EngR joins in. Discussion of 'slow go' and 'no go' areas of map
1:30	AOPSO at TM adding to the overlay
1:34	OPSO at wallmap with IO, discussion HVU; EngR working with FOO
1:37	eng consults map
1:37	Comd at desk working
1:37	AOPSO at TM, filling in areas; OPSO at WM
1:39	IO goes over to TM with AOPSO
1:40	FOO consults map
1:40	OPS O and IO at map #1 - defining ECOA AOPS O and FOO at map #3
1:46	OPSO talking to Comd, he feels they are at Factors and Deductions, at 11am hoping to have that complete and will then do metocog; Comd wants to do metacog now and then at 11:10 wants to finalize CPG)
1:49	FOO consults map w/another staff member
1:50	group meets for metacognitive checks
1:50	Another team meeting. Discussing assigned and implied tasks Have moved into defining ECOA
1:50	Formal brief at TM for metacog: Comd working on taskings and objectives, then in 10 mins will issue IPG
1:50	Comd outlines own tasks in CJTF, clairfy and define FIX
1:50	Comd discusses movement through area, key thing the Comd wants to focus on; then goes through all the Implied tasks (asks each team member for input as to what they each think the implied tasks are), discussion about how to work with other groups and if they can change their boundaries
1:50	Comd makes sure that he has checked in with everyone before moving on
1:58	deduction made
2:02	commander asks Bob if boundry change is possible
2:05	OPSO comes up with other implied tasks (Comd directs him to write them down)

Time	Observation
2:12	discuss implied tasks (about 5 of them)
2:13	Comd says I figured out what I want to do already OPS O recommended breaking to give Comd time to develop planning guidance by 12:00 Summarize - probably have developed ECOA but need to formalize it
2:13	Comd talks about E most dangerous COA
2:16	Meeting ends
2:17	FOO talking with IO about how fast things are
2:17	Bob directing EngR, OPSO, and AOPSO about bge, etc (at TM)
2:17	Comd at own desk
2:17	OPSO suggets that meeting ends so that commander has time to plan
2:18	meeting ends
2:19	all listening to Bob except Comd, who is looking at IOPP and scenario
2:20	group (with out commander) meet w/Bob to discuss strategy
2:22	IO and OPSO at wall map with EngR; playing with overlay on map and then bringing it over to table map
2:23	Took overlay from map #1 and put it on map #3
2:26	group (with out commander) maps transparent sheet onto another one (table)
2:26	AOPS O asked what the OPS O wanted him to do. Wanted him to help IO define ECOA
2:26	OPS O checked process
2:27	OPS O went to map #3 to discuss ECOA with A OPSO and IO
2:28	FOO and EngR discuss metacheck… FOO says more behavioural than technical
2:29	eng and FOO review IOPP chart and clarify steps
2:31	FOO reviews map
2:31	FOO and eng review IOPP process chart
2:32	everyone but Comd at TM, Comd talking with Bob about how to outline COA
2:34	group (without commander) crowd around table map to discuss COA
2:37	IO drawing on TM
2:38	IO puts ECOA on map #3 OPSO is listing PIRs, ECOA
2:40	OPS O writing Draft Mission Statement
2:41	FOO and AOPSO review asset list
2:41	OPSO talking with Comd at Comd's desk on responsibilities and information
2:41	IO talking with EngR at TM, discuss outlet to attack, counter attack
2:43	OPSO joins EngR and IO at TM
2:45	Comd with Bob, discussion IOPP; OPSO waiting to talk to Comd
2:45	Eng, Foo, IO, Aopso at TM talking about visibility assessments
2:49	AOPSO, FOO, Eng discuss at back map, then move on to asset list
2:52	ECOA discussion involving OPS O/IO/ENG/AOPS O/ FOO
2:52	FOO and AOPS O discussing equipment
2:53	group (without commander) meet at table map
2:53	Comd has been outlining a COA
2:53	IO and Opso at TM, drawing things
2:53	Aopso and Eng and FOO at Eng flap paper list
2:55	everyone meets to present most likely COA?
2:55	Comd leads "coord brief" around table map
2:55	Each member discusses isses (IO discusses ML ECOA, Comd says that is also MD, Comd wants IO to start thinking about control measures, etc the enemy will do)
2:56	ECOA by IO

Time	Observation
	Comd wants more development on ECOA
2:58	commander suggests that IO modify his plans
2:59	Mission statement by OPS O
2:59	SA check on mission statement
2:59	Comd's intent, based on mission statement is clarified
2:59	Mission Statement - drafted by OPSO, read out
2:59	Comd explicitly goes through SA issues to ensure they are addressed by mission statement
3:00	discuss mission statement
3:03	test whether mission statement satisfies purpose
3:04	assumption made
3:05	Comd's planning guidance Establishing what is known
3:05	AOPSO outlines roles that are expected (for other Blue F)
3:05	Comd went through list of different applied tasks that were created
3:05	Comd outlines 4 moving parts in their own COA (not sure about groupings and taskings yet
3:08	commander lays out skeleton COA
3:09	Comd approves mission statement
3:10	Time is constrained therefore Comd provides skeleton COA - 3 phase: deny gap (black diamond route) to force enemy into D2 ; fix in D2; secure LoD and assist in counter moves through D2 Therefore have sufficient info but time is constrained and so skeleton COA is provided Staff to go away and figure out why COA won't work
3:12	Comd provides outline for each person
3:12	Comd requests feedback later on about whether or not a certain aspect is a good idea
3:14	2 priority tasks assigned by commander
3:15	Additional specific planning guidance Abandoning KZ D1 -> why is this a good/bad idea? How do we 'sense' the battlespace?
3:16	Comd directs all to stay in high level of analysis, and punch holes in what has been set out
3:21	Briefing ends
3:26	meeting ends; break for lunch
3:26	LUNCH!
4:07	OPS O at map #3
4:08	FOO doing visibilty assessment at TM; others are finishing the NASA TLX
4:12	Whole team meeting at map #3 Comd asked for update
4:12	Comd discusses what they are all doing; FOO bringing up concerns to Comd
4:12	IO is templating the enemy
4:12	Comd outlines specific info that he wants
4:13	FOO consults map
4:15	OPS O and AOPS O discussing integration with other units
4:17	ENG and Fires Talking
4:18	4 meet at table (including commander) to discuss COA
4:20	Used Google satellite imagery to visualize terrain elevation
4:22	AOPS O locating FOO
4:28	Full group discussion on view ability of KZ 1 and 2 and where they all need to see (looking at gradients)

Time	Observation
4:29	AOPS O talking to FOO at map #1 - silos
4:30	OPS O still at map #3 -> briefing COA
4:33	commander asks Bob what he expects for outcome
4:35	FOO and AOPSO meet at back map to discuss positioning of troops
4:35	Using google maps to get layout and better understand
4:35	Comd clarifying with Bob what the final products are
4:35	IO with OPSO at TM
4:36	Comd asked for progress check - Revised time for validated COA to 13:55
4:43	Comd Criteria for Success: - No enemy move past rear boundary - No enemy on South of diamond route west of BP 101 - LD1 must remain clear - Retain at least 70% combat effectiveness - Main effort = BP 101 Some refinement of specific issues
4:43	Final approval of the COA (formal presentation) around TM
4:43	Comd presents Criteria for Success (he acknowledges this should have been done earlier)
4:44	eng asks OPSO what info he'll need on the matrix
4:44	FOO and AOPSO discuss COA strategy
4:48	Comd encourages everyone to talk about the 3 phases of the COA
4:49	Lost about 10 mins on clock
4:49	commander gives criteria for success
4:51	IO briefing on ECOA OPS O briefing on COA
4:54	staff discuss COA + criteria for success
4:56	IO gives his view, then OPSO (seemed to be some major breakthroughs about where to locate staff)
5:01	each individual explains his part of COA
5:02	ENG briefing on COA
5:04	FOO briefing on COA
5:04	FOO talked
5:11	Eng talked
5:17	Comd: start thinking about synch matrix, wargaming at 14:45
5:17	Comd outlines what he wants: OPSO to do groupings and taskings, Mortars to be finalized, ENG to confirm things… back to discuss in 15 mins
5:20	meeting ends; individuals go off to revise COA
5:20	OPS O, AOPS O and IO working at laptop in front left corner of room
5:21	all working independently
5:27	FOO at TM, Eng at desk, AOPSO & OPSO & IO discussing; Comd looking at his wall, and thinking
5:31	Comd at TM, others along at desks
5:35	Cds calls them back together
5:35	OPSO led through plans, IO led thorugh plans, IO led through what to expect from enemy
5:36	Wargaming
5:36	Comd very aware of time
5:44	Phase 2 of their actions
5:49	group meets to discuss COA and do war gaming

Time	Observation
5:53	Comd gave further direction - Staff responsibilities to complete planning
5:54	They move to CONOP (which is quickly approved)
5:55	Plan/Order creation - everyone breaks into own groups (AOPSO working with OPSO at laptop)
5:57	Meeting adjourned COA validated CONOP was developed with all previous steps - Assume High Cmd has been briefed and CONOP approved
5:58	Plan being developed
5:58	Orders being written
5:58	Contingencies being done (by IO)
5:58	Comd wrote responsibilities: G2: Terrain, weather, enemy intent, enemy COA, BIG PIRs Comd: Mission statement, criteria for success, concepts of ops G3: GP and Tasks Fires: Fire plan and CFSP ENG: Barrier plan
6:06	group meets again--commander assigns tasks
6:07	All still working on own
6:10	AOPS O assisting IO
6:10	ENG talking to Comd about obstacles and concerns
6:16	IO at TM, Aopso and Opso at laptop talking with Comd, Eng and FOO say they are pretty much done
6:17	Eng and IO discuss at TM
6:31	eng approaches table to talk to IO
6:33	Back brief to Comd begins
6:37	Taped presentation begins
6:42	G3/OPS O - Group and tasks
6:46	Fires - Artillery, CAS, FOO, etc.
6:49	group presents to Bob
6:51	ENG - creating and exploiting obstacles - Barrier Plan
6:56	Comd wrap up - war gamed against ECOA - most likely and most dangerous - recommendations to support subsequent phases - moving lines of departure - moving rear boundary - requesting all CAS sorties High Cmd Question - how long will each phase take?
7:09	Finish presentation (which is 16:25 real time)
7:23	group fills out NASA-TLX and MOPS

OPP Yellow Team

Time	Observation
0:00	Reviewed structure of armoured Bdge
0:00	Team members: Comd, OPSO, FOO, EngR, IO (only 5 of them!)
0:00	Staff break from scenario presenation, all start reading
0:00	Return from debriefing, Cmdr initiate OPSO to organize FOO and IO
0:03	Step 1 - initiation

Time	Observation
	Fires and ENG working together to determine structure and composition (ORBAT) of
0:06	the armored BG
0:06	Putting info on flip chart 1
0:07	Cmdr leaves to go planning
0:09	IO at table map, taking notes
0:09	OPSO looking at OPP
0:09	FOO/Eng taking notes off weapons listings from file on computer
0:12	Cmdr returns with a purple booklet and butcher paper
0:14	IO talking with OPSO at TM
0:14	OPSO is looking at OPP to determine timeline for deliverables
0:14	Prepares staff guidance
0:17	Comd clarifying the number of troops and planning for CPG
0:17	OPSO presents a timeline to the Comd of how to follow the process - agreed upon
0:17	Eng and FOO still noting wpns from computer file
0:18	Confers with SME regarding available units
0:19	Confers with OPSO, agree 2minutes until issue to staff
	Comd briefs expectations (see COMD's initial guidance below)
0:20	Will issue Comd's initial guidance at 9:25
0:20	OPSO calls staff in for CPG
0:20	All attend
0:20	Cmdr continues to prep staff guidelines
0:21	OPSO organize staff at Cmdr informal order
0:23	Guidelines to staff are issued
0:24	OPSO to split up tasks among team
0:25	Decide that IPG will be at 9:25
0:25	Cmdr working on initial guide briefing
0:25	Cmdr prepares IPG
0:26	Staff return to what they were doing
0:26	OPSO talking with Bob about when H hour is
0:26	Cmdr confers with FOO regarding troop composition
0:26	Cmdr checks with OPP sheet and SME to confirm objective for 15:00
0:27	Cmdr reflects on H hour timing
0:28	OPSO at laptop, Eng and FOO still copying info from computer (writing on flapsheets)
0:28	Begins rough draft of timeline, taking into consideration the objective deliverables
	OPSO and IO talking at TM about limits, enemy concentation, etc; leading IO through
0:32	what factors he would like to consider
0:32	Comd at desk, looking at map
	Exhibits very close concern for adherence to the process and makes process vs. time
0:33	considerations
0:35	Fires and ENG discussing no fire line etc. at map #1
0:35	FOO with Eng, looking at where everyone is and where wpns are, etc
0:35	IO still at TM taking notes
0:35	OPSO at his desk
	They are starting to look at issues that they need to deal with, and what they need from external groups, discussion of ML ECOA at WM… realize that they have to follow the
0:35	process though
0:36	Begins writing the IPG and develops a timeline
0:39	OPSO woking with Comd
0:41	Confer with OPSO regarding faults or weaknesses of IPG
0:41	Agree that the IPG team brief will commence in 2 mins
0:42	OPSO passes msg onto team
0:42	Cmdr further develops IPG as on overlays, disc with FOO

Time	Observation
0:43	Posted own ORBAT on far wall
0:44	Announce IPG in one minute
	Comd initial guidance
	2 x En COA: Most likely, most dangerous
	3 x Fr COA: All must be significantly different
	Guidance to staff:
	1) internal coordination
	2) external coordination
	- 4 PPCLI
	- 4 RCR
	3) Sp/Sub Units
	- 4 PPCLI: plan and current location start
	- 4 R22eR: old barrier plan
0:45	- current gun/AFV state
0:45	IPG commence, indicates process steps reference to
	IPG - schedule for planning on flapsheet; scheduled Mission Analysis Brief (MAB) at
0:46	10:20
0:47	Confer with OPSO
0:48	Bob gave bit of Intl brief
	Initial Comd Guidance
	930 Issue ICG
	1020 Mission Analysis Brief
	1050 Issue CPG
	1200 Lunch
	1240 Deliver info brief on En and Fr COA (2 &3)
	1330 Deliver decision brief
	1400 Gain CONOP approval
	1500 Back brief
0:48	HR not before 1700
	ICG 2 - In Auth - 4 PPCLI, 4 RCR; Recce - RGPS auth, move to apple pie now; MOV -
0:48	not before 1530
0:49	
	Meeting begins around map #3 (IO, OPS O Fires, ENG)
0:50	Mission Analysis - implied and assigned tasks
0:50	Factors and deductions
0:50	Team confer with SME
0:51	All grouped at TM, Bob is giving info about other groups and scenario
0:51	OPSO leading group in what needs to happen before MAB
0:51	Comd is not at TM, is looking at OPP
0:54	All looking at TM, discussion how to create Mission Statement (MS)
0:54	OPSO writing down pts for MS
0:54	Looking for planned and implied tasks
1:00	All but Comd looking at ECOA and attack plan, confirming goals
1:00	Cmdr checks map, plans to check with team during development of mission statement
1:05	OPSO trying to confirm MS
1:11	Consulting purple book, determining what other aspects need to be included in MS
1:15	Cmdr develop a list of issues and questions
	Some discussion of what will happen after
	COG = C2
	Combat power
1:19	What other units will be doing
1:22	All still at TM, looking at COA possibilities (2 or 3) and constraints, factors

Time	Observation
1:22	Looking at list in CFOPP for MAB format
1:22	OPSO brought back on topic, say that not at COA development yet
1:27	Cmdr confer with SME regarding primary and secondary objective
1:29	Key strengths, decision points (from CFOPP book)
	Mission analysis meeting finished
1:30	All went back to prepare for mission analysis brief
1:30	confirm readiness of OPSO to commence Mission Analysis Brief at 10:20
1:32	Break from TM to do final prep for MAB
1:32	IO stays at TM, taking notes and writing on overlay
1:32	OPSO at own desk
1:35	Mission Analysis Brief begins around map #3
1:35	MAB started. Staff present to the Comd
1:35	IO discuss maps, lead elements, limitations
1:35	Commence Mission Analysis briefing, initiated by OPSO
1:36	IO
1:38	OPS O: gave mission statement
1:38	OPSO gives mission analysis (goals, tasks), criteria for success, constraints, CoG for enemy and MS
1:39	On going Q&A throughout for clarification when needed
1:43	Cmdr clarifies mission objectives, c of g, location of OPFOR
1:44	Comd then clarifies issues that he's figured out (liked the MAB)
1:47	Comd is providing additional guidance
1:50	Finalizing mission statement
1:50	All still at meeting, Comd outlining that he will do the CPG at 10:50; tells staff what he wants them to do in the mean time
1:50	Refines mission statement
1:51	Finalized mission statement
1:51	Cmdr states 10:50 for CPG
1:52	Asks for train analysis, routs, assigns K2, shaping ground
1:53	Mission analysis brief ended
1:53	Fires and ENG worked separately
1:55	end of meeting
1:56	Begins CPG preparation
1:59	Cmdr readies CPG
2:00	Comd is at the flapsheet, creating the CPG
2:00	Eng and FOO at TM, writing on overlay
2:00	OPSO at laptop, IO is helping OPSO
2:02	Cmdr confers with SME on troop and unit availability
2:09	Bob with Eng going through ORBAT; others working independently
2:09	CPG commence, Cmdr >> OPSO >> Team
2:10	CPG
2:10	Comd CPG. Comd outlines mission, intent…
2:13	Mission statement confirmed
2:21	Comd looking at OPP with group to clarifiy their next steps
2:21	Comd outlines what he wants: 3 COAs, 2 ECOA (ML and MD); also outlines specific things to look for when developing the COAs
2:22	CPG ends
2:22	4 staff gathered around bird table
2:22	end of meeting; everyone breaks to own work stations
2:22	Cmdr brings staff up to speed on OPP map
2:27	Finish CPG
2:30	Staff working together at TM; Comd on flapsheet, outlining symbols

Time	Observation
2:33	Comd enters discussion, telling what he wants from the individuals
2:34	Some additional Comd analysis guidance
2:35	Cmdr provides guidance on attack positions
2:45	All around TM, discussing weapons and COA's (3)
2:51	Looking at copies of maps, each developing 1 COA onto a map (IO, Eng, FOO)
2:54	OPSO talking about schedule to Comd (lunch?); supposed to do info brief at 12:40
3:01	OPSO assisting with COA development
3:02	Cmdr & team use/develop new strategy for creating COA's
3:03	Lunch
3:03	LUNCH
3:03	Lunch begins
3:43	Back from lunch, filling out NASA TLX
3:47	FOO and Eng at TM; OPSO at desk with OPP book; Comd at desk, looking at flap papers (schedule and IPG info)
3:55	Comd looking at map and thinking
3:59	Cmdr investigates and thinks about COA on map
4:00	Info brief on COAs around bird table
	Comd queries COAs to improve solutions
	Get rid of Fr COA 3
	Agrees with En COA Dang/Likely
	Develop Fr COA 1
	Suggestions for improvement
4:00	Develop Fr COA 2
4:00	Proposed another COA refinement (almost a new one)
4:00	Info Brief: from staff to Comd
4:00	OPSO led through issues that need to be covered
4:00	IO doing Enemy ML and MD
4:00	Led Comd through COAS
4:00	Info brief begins
4:07	Comd asking questions
4:07	Cmdr offers advice and suggestion, clarification, and considers combat power
4:17	COA refinement and development along with Cmdr guidance
4:18	Comd removes a COA (so only 2 now); agrees with MD and ML ECOA
4:18	Wants the other 2 further developed
4:21	
4:26	Info brief ends, staff begin to refine COA
4:26	End of CPG
4:26	Comd goes to his own WM
4:26	Staff stays around TM, discussion what the Comd suggested
4:26	Info brief ends, Cmdr investigates map
4:34	Planning for decision brief (DB), all working at TM
4:34	Comd talked with staff about symbols
4:40	Cmdr further develops COA maneuvers
4:50	Staff still at TM, Comd at own desk looking over
5:01	Cmdr begins phase * unit orders Matrix
5:13	Cmdr confer with OPSO to ready the team for decision brief
	Decision Brief
	OPS O presented pros and cons of each Fr COA
5:14	Therefore comparison and wargaming has been done
	Recommended COA 1 due to simplicity and speed (15 mins faster)
	70-75% Combat power in COA 1
5:14	60-65% Combat power in COA 2

Time	Observation
	Already have eyes in road in COA 1
	Comd prefers COA 2
	- PPCLI move at same time - need to give them space
	- Draws attention away from PPCLI
5:14	- Addresses EN most Dang
5:15	DB
	Staff present COA 1 and 2 (positives and negatives for both). Led by OPSO.
5:15	Recommend COA 1.
	Comd asks questions (specifically about how the wargaming went). Likes 2 better.
5:20	Comd explains why.
5:20	Cmdr disagrees with staff selected COA, COA1 prefers COA2
	Want to develop COA 2 further
5:23	Moving into plan development (Comd said so)
5:23	Comd goes to Bob for CONOP approval
5:23	Further refines COA2
5:25	CONOP approved
5:25	OPSO looking at OPP
5:25	See what they need to do: identify issues and shortfalls
5:25	Comd outlines the format that he wants for issues and shortfalls; But then Bob says that they don't need to issues and shortfalls….
5:25	Gains CONOPS approval
5:27	Plan Preparation, Comd involved
5:27	Fires and ENG working separately. Fires writing and ENG drawing scheme of maneuver
5:29	Cmdr works with Staff on CONOPS development
5:33	OPSO writing on matrix
5:33	Comd writing on another matrix
5:33	IO and FOO at TM, creating ovrelays
5:33	Eng at another flap sheet
5:35	Cmdr filling in Orders Matrix
5:45	
5:55	Plans done
5:57	Start back brief to Bob
5:58	Plan back brief - Comd
5:59	Cmdr gives Issue Plans (back brief)
6:00	Team involved in components of positions
6:01	OPS O
6:04	ENG
6:06	Fires
6:15	End

IOPP Blue

Time	Observation
0:00	Comd gave initial guidance before scenario briefing
	After Lora's presentation group took 5 minutes to discuss
0:00	Bob's situation briefing
0:00	commander and Logi clarify process with kent at butcher paper pad (break-up at 8:43)
0:00	FOO reads notes
0:02	Logi leaves room
0:02	Comd and IO meeting in separate room discussing enemy - identify most likely place to be - only creating most likely COA

Time	Observation
0:02	945 for MA Brief so have lots of time to do enemy situation
0:03	OPS O and AOPS O are reading Frag O to try and understand the resources they have
0:04	Foo asks for booklet that contains explanations of symbols
0:09	Logi returns to room
0:11	Comd, OPS O and AOPS O are discussing what they can do while looking at overlay
0:11	Logi and FOO each going over information from folder
0:13	FOO asks IO for clarification about map features
0:15	Comd and A Ops O looking @ map discussing terrain, etc.
0:15	Discussing applied tasks
0:15	Note: Kent tells them about crossings available/not
	Comd does TO&E on flipchart to confirm what assets he has
0:15	8:42 (real time)
0:16	Logi approaches and examines map
0:16	AOPS O returns to desk
0:18	OPS O is working on Implied task
0:18	OPS O: formal Mission Analysis uses sheet as an outline (same as yesterday)
0:19	AOPSO joins Logi at map and both leave room
0:21	Logi returns to room;continues examining map
0:21	Comd reviewing orders
0:22	AOPS O states a possible assumption which leads to discussion
0:22	FOO asks IO for more clarification about typography of land
0:23	Logi returns to table; starts making notes
0:23	Comd tells OPS O and AOPS O to work independently
0:23	Staff and Comd are doing individual review. Comd is sitting and reviewing a lot more material today
0:23	Comd periodically talks to staff when he notices that something may be of value to an individual
	During mission analysis: - OPS O is working on implied tasks - AOPS O is working on facts, deductions and assumptions Occasional chatter between OPS O and AOPS O
0:23	Communication between AOPS O and OPS O becomes more frequent
0:23	Aiming for mission analysis brief (9:45 real time)
0:27	Logi examines map
0:29	Logi returns to seat
0:33	Logi approaches FOO to discuss enemy situation and own resources
0:35	Comd noting tasks, implied tasks and factors
0:35	Comd asks Ops O and A Ops O to be ready to discuss factors, deductions and tasks @ 930
0:38	FOO joins commander and IO to ask a question about enemy positioning
0:40	Comd and Log O @ map talking about number of sortie's to use - decided on 6
0:40	Logi joins commander at map--they start discussing;Kent joins them shortly after
0:42	Logi goes over to FOO and they discuss
0:45	*Comd talking to Kent about most likely E COA (Comd asked for his input) and assumptions
0:45	Note: Comd asked Kevin (Log O) to ensure doing situation awareness throughout and ensure they provide all comms to lower forms, also told Ops O not to look @ map today!
0:46	FOO aks IO for clarification
0:46	Logi starts to make diagrams on butcher pad
0:49	FOO examines map on wall
0:51	FOO asks for photocopy of his diagrammed map
0:52	Comd sits down with OPS O and AOPS O for an informal briefing

Time	Observation
	Comd asks group if 9:45 is still reachable, mentions that can move it to 10:00 (Comd
0:52	showing greater flexibility)
0:52	This informal briefing is more discussion and analysis oriented
0:52	FOO discusses enemy situation and own assets with /IO
	Comd, Ops O and A Ops O meet to discuss assumptions, deductions, implied tasks and
0:55	facts - informal brief to allow Comd to develop skeleton COA
	commander asks FOO how he is doing
0:57	FOO moves to a seat closer to the rest of the group
0:58	FOO asks commander question--Kent helps answer question
0:59	commander asks Logi question
1:01	FOO moves back to orginial seat
	State assumptions in informal brief (Comd wanted this informal brief so he could
1:03	visualize skeleton)
1:03	Logi joins commander, OPSO and AOPSO
1:05	*Note: made mistake with tasking matrix so Log O updates it
1:05	Ask Kent about bridge capability (Kent acting as Engr)
1:05	*Took picture of updated tasking matrix
1:05	Logi returns to diagramming in butcher paper
1:06	commander obtains map from IO
	Comd asks A Ops O to write key assigned and implied tasks in prep for mission analysis
1:08	briefing
1:08	Ops O writes msn statement onboard and key deductions
	Comd asks if everyone will be ready in 5 mins. States that the person still working can
1:08	call the meeting when ready
1:09	commander calls meeting in 5 minutes
1:09	OPS O and AOPS O start putting their information the white board
1:11	FOO leaves room
	Comd outlines meeting - Mission Analysis Briefing
	- Report individual findings
1:13	- As a group discuss skeleton COA
	Beginning of meeting: stated by Comd want to synthesize info collected over last hour
1:13	- Comd listening more in meeting and asking questions. States interpretations out loud
	Comd explicitly states assumptions: e.g. Enemy is fixed. Also written on white board
1:13	with other assumptions
	Each person spoke, probed by Comd…discussion led to modification of the mission
1:13	statement
1:14	FOO returns to room with coffee
1:14	Msn analysis brief:
1:14	IO - enemy likelyu COA
1:14	A Ops O - implied and assigned tasks
1:14	Ops O - key deductions
1:14	Then develop skeleton COA together
1:14	Comd: "Once developed skeleton COA, certain level of commitment"
1:14	Comd notes key assumption is enemy is fixed
1:14	Ops O - msn, implied and assigned tasks and key assumptions (3) and msn statement
1:14	Comd approves msn statement
1:14	A Ops O discusses additional factors and deductions
	*Comd says that point of this is to synchronize info so all have same info going into COA
1:14	development
1:14	Comd gives skeleton COA including assumptions and initial thoughts (Not CPG!)
1:14	Movement and effects (destroy HB & C2), risks, admin
1:14	Says will come back with criteria for success in a minute

Time	Observation
	*Says what backup COA is * and asks IO to look into it (Alternate COA!? Is alternate
1:14	crossing viable?)
1:14	IO discusses other crossing options to go north
	group meeting starts--each present info
	IO
	OPSO
	Logi
	AOPSO
1:15	made false assumption about accessibility of highway 2
	Comd sets outline for rest of process and addresses the importance of common
1:32	understanding (sit awareness)
	Again goes through everyone to see if they have anything to add (meta-cog check
1:35	maybe?)
	Comd has listened to everyone and begins his talk - gives skeleton COA verbally (this is not the CPG, Comd is just giving out ideas)
	- emphasizes that this is a Skeleton COA and therefore open to discussion. Repeats future direction (i.e. mental wargaming)
	- outlines risk
	- Defines which COA they are going to focus on.
	- Comd will come back with CPG
	- Comd vocalizes an alternative approach just in case
	- Conclusion: Fairly good picture so team can proceed. CPG at 10:45
	- In the meantime think about advantages and risk mitigation if take different bridge -> is
1:36	another crossing viable?
1:39	commander begins discussing skeleton COA
	Comd says come back @1045 for CPG (~2:00 ex time)
1:45	ends 1:45:00
1:45	Note: mental wargaming already happening - comd asking what if? So what?
	Brief done
1:47	SME - Start wargaming: what if, so what?
1:48	meeting ends; commander asks group to evaluate viability of skeleton COA
1:54	break
1:57	Comd in another room preparing CPG
1:57	OPS O, AOPS O, FOO, IO: exploring bridge route further on overlay map
2:00	Comd off doing CPG
2:00	Ops O, A Ops O, Log O and FOO collaborating
2:06	AOPSO, OPSO, FOO and Logi at map discussing
	Comd returns to give CPG
	- asks for follow up: recommendations, conclusion: doesn't mitigate risk
	- CPG given verbally, will post additional info later
	- agrees with mission statement, assumptions etc
	- states end-state, criteria for success, effects, risk acceptance, CONOP
	- Comd used term 'Situational Awareness'
2:11	- Comd gives CONOP
2:12	CPG presentation by Comd - all present
2:12	Ops O recommending not taking alternate route
2:12	CPG - mission, applied and assigned tasks and assumptions confirmed
2:12	Criteria for success (5):
2:12	Conduct of attack rehearsals
2:12	Use of FAST CAM
2:12	Combat air support
2:12	Elimination anti-armour

Time	Observation
2:12	Max comms with higher and recce for accurate picture of enemy
2:12	Effects - destroy 75% of HB
2:12	Risk acceptable
2:12	CONOP
2:12	Describe by phases with assets (order of march)
2:12	Decision points
2:13	commander returns to room; group meeting begins
2:14	commander gives planning guidance and criteria for success--5 criteria for success are given
2:21	commander gives CONOP Says carry forward with COA development
2:24	ends 2:24:00
2:24	Says let's do meta-check then go off and do COA validation @1300
2:24	Absorb this as a team, do a meta check, go off to work individually (This is how Comd concludes CPG)
2:25	Beginning of COA development
2:26	meeting ends
2:29	Logi and FOO work independently
2:30	Ops O notes that comd has actually given them more than skeleton COA
2:30	A gap in the skeleton is brought to the Comd's attention therefore sits down to fix it
2:35	Creating task matrix (Log O)
2:36	commander suggests to Logi that he starts on his matrix
2:36	Logi leaves room
2:39	Comd tells everyone to think about wargaming. Validation brief at 13:00, drive process forward
2:40	Start mental wargaming based on tasking matrix
2:40	Want validation brief @1300
2:40	Comd wants time appreciation
2:42	Cmdr asks for info to be presented on whiteboard - AOPS O: time depreciation - OPS O: working on each phase (coordination among phases, line of march, coordination among elements, breakdown into subunits) - LOG: doing the matrix on butcher paper (using the CONOP and his personal notes that he made during the CPG
2:45	Logi working on matrix
2:50	FOO is taking map measurements for AOPSO Comd telling group about meeting he had with IO about 10 minutes ago.
2:53	- Telling them new info and thoughts to consider…leads to further discussion Individuals start giving Comd what they have done.
2:54	Discussion
2:57	FOO asks commander question to clarify an issue Comd brings new aspect to think about for AOPS O in terms of time depreciation.
2:58	Then generally announces 'this is the self check'
2:59	Issue with terminology -> ask SME
2:59	Small changes are being made (come from discussion)
2:59	Have been doing mental wargaming for 30 mins
3:00	Mental wargaming for about last 20mins, by phase
3:00	Logi still working on matrix
3:01	commander, OPSO and AOPSO engaged in meta-cognitive checks
3:03	commander clarifies terminiology with Kent
3:04	Foo and commander clarify process
3:04	commander clarifies an issue with Kent

Time	Observation
	Lunch - mental wargaming at lunch??
3:09	What ifs -> resulted in changes in tactical plans
3:09	Participants finished lunch before Observers
3:10	Lunch
3:10	Lunch break
4:00	Logi and AOPSO working on matrix; FOO prepares transparency for putting over map
4:03	OPSO asks Kent question
4:04	Had already begun the process. Another butcher board - drawing a map
4:05	NASA TLX
4:09	group completes NASA-TLX and MOPS
4:09	Logi continues work on matrix
4:11	AOPS O working with IO on matrix
4:12	Comd, FOO, OPS O: discuss attack position on butcher paper map
4:20	COA validation brief
4:20	Comd comments on great job on mental wargaming
4:20	Ops O - major Δ in initial plan
4:20	A Ops O presents
4:20	Comd going to present CONOP to Comd after this move into COA development
4:24	Validation Briefing
4:29	briefing meeting begins
4:47	commander changes one of the criteria for success
4:49	meeting ends
4:54	commander, IO, AOPSO leave room
4:56	Presentation of orders
4:56	Describe op in phases (4)
4:56	Higher Comd gives feedback
4:56	Brief High Comd
5:01	briefing to Kent begins
5:09	brifing ends
5:10	group completes NASA-TLX and MOPS

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Annex D: SME BARS

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
Quality of the Mission Analysis Process				
Look for: (1) The commander provided the necessary guidance to orient the staff (2) The process remained synchronized and integrated and served to keep the commander and staff on a common basis (3) The commander and staff displayed situational awareness **Observations:**				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
Quality of commander's guidance				
Look for: **Observations:**				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
Quality of Staff Analysis process				
Look for: (1) The staff developed appropriate factors and key deductions (2) The staff displayed individual initiative and creativity within the guidance provided by the commander **Observations:**				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
Quality of COA Evaluation/Validation process				
Look for: (1) The staff fully evaluated each friendly and enemy COA collectively and, as required, independently (2) All COAs carried forward appeared to be viable **Observations:**				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
Quality of working documents (e.g., overlays)				
Look for: **Observations:**				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
Overall efficiency team when applying planning process				
Look for: (1) Commander and staff efforts were complementary throughout (2) The commander and staff applied all necessary steps in a logical sequence (3) Commander and staff continued to build on previous work as the plan was developed **Observations:**				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional

Quality of selected COA

Look for:
(1) Selected COA is complete and viable and has fully accounted for the enemy's most dangerous COA
(2) Selected COA is doctrinally sound

Observations:

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional

Quality of CONOP

Look for:
(1) The CONOP fully describes the planned operation from beginning to end.
(2) The CONOP appears to synchronize "effects" and the commander and staff understand the implications of those effects

Observations:

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional

Overall quality of Plan

Look for:
(1) The plan is easily understood by sub-unit commanders
(2) The plan is simple yet incorporates flexibility
(3) The plan is workable and adheres to the principles of mission command

Observations:

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
Overall quality of Order				
Look for: (1) The tools used (matrix order, groupings and task matrix, etc.) reinforce critical aspects of the plan (2) The order is easily understood by sub-unit commanders **Observations:**				

Annex E: Participant Rating Scales

Please rate the following using the scales provided:

Ease of use of planning process

1. Very difficult	2. Difficult	3. Standard	4. Easy	5.Very easy

Learnability of planning process

1. Very difficult to learn	2. Difficult to learn	3. Standard	4. Easy to learn	5.Very easy to learn

Efficiency of planning process

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional

Effectiveness of planning process

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional

Complexity of planning process

1. Very complex	2. Complex	3. Standard	4. Simple	5.Very simple

Suitability of planning process in this context

1. Very unsuitable	2. Unsuitable	3. Standard	4. Suitable	5.Very suitable

Overall user satisfaction with planning process

1. Very unsatisfied	2. Unsatisfied	3. Standard	4. Satisfied	5.Very Satisfied

User trust/confidence in planning process

1. None	2. Low	3. Medium	4. High	5.Very high

Reliability of planning process to produce a good plan

1. Very unreliable	2. Unreliable	3. Standard	4. Reliable	5.Very reliable

Potential for planning process to lead to errors in overall Plan

1. Very high	2. High	3. Standard	4. Low	5.Very low

Potential criticality of errors in overall Plan that may be associated with planning process

1. Very high	2. High	3. Standard	4. Low	5.Very low

Suitability of planning process in a variety of operational contexts

1. Very unsuitable	2. Unsuitable	3. Standard	4. Suitable	5.Very suitable

User trust/confidence in the overall Plan to complete the mission

1. None	2. Low	3. Medium	4. High	5.Very high

Reliability the overall Plan to complete the mission

1. Very unreliable	2. Unreliable	3. Standard	4. Reliable	5.Very reliable

Accuracy of the overall Plan in completing the mission

1. Very inaccurate	2. Inaccurate	3. Standard	4. Accurate	5.Very accurate

Overall quality of Plan

1. Very low quality	2. Low quality	3. Standard	4. High quality	5.Very high quality

Realism of scenario

1. Very unrealistic	2. Unrealistic	3. Standard	4. Realistic	5.Very realistic

Realism of time available for planning

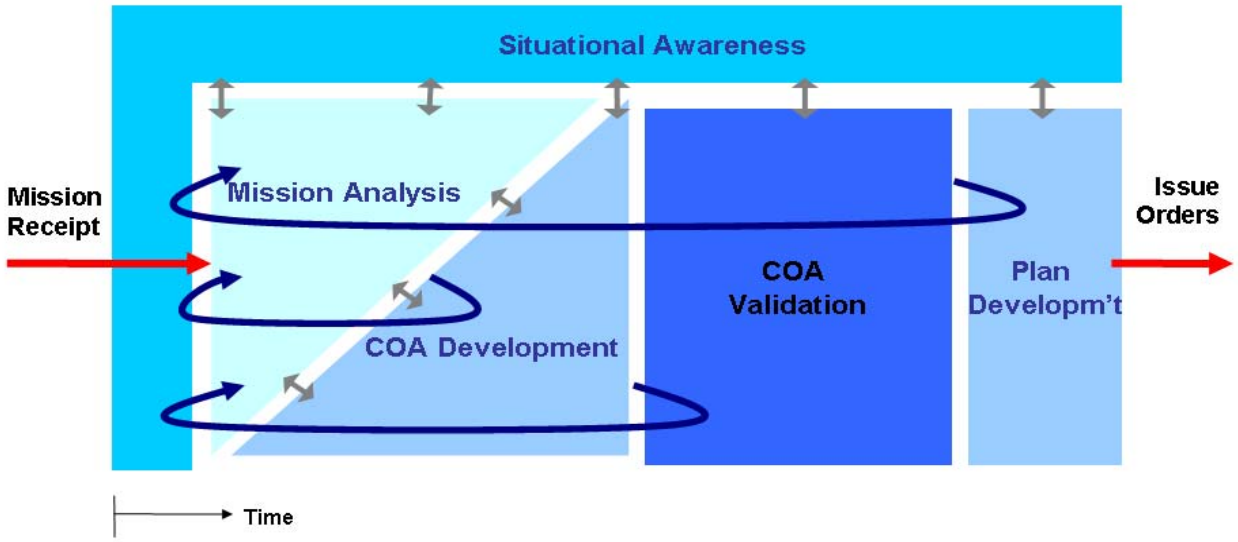
1. Very unrealistic	2. Unrealistic	3. Standard	4. Realistic	5.Very realistic

Degree to which the team followed the process

1.Not at all	2. Partially	3. Generally	4. Mostly	5.Precisely

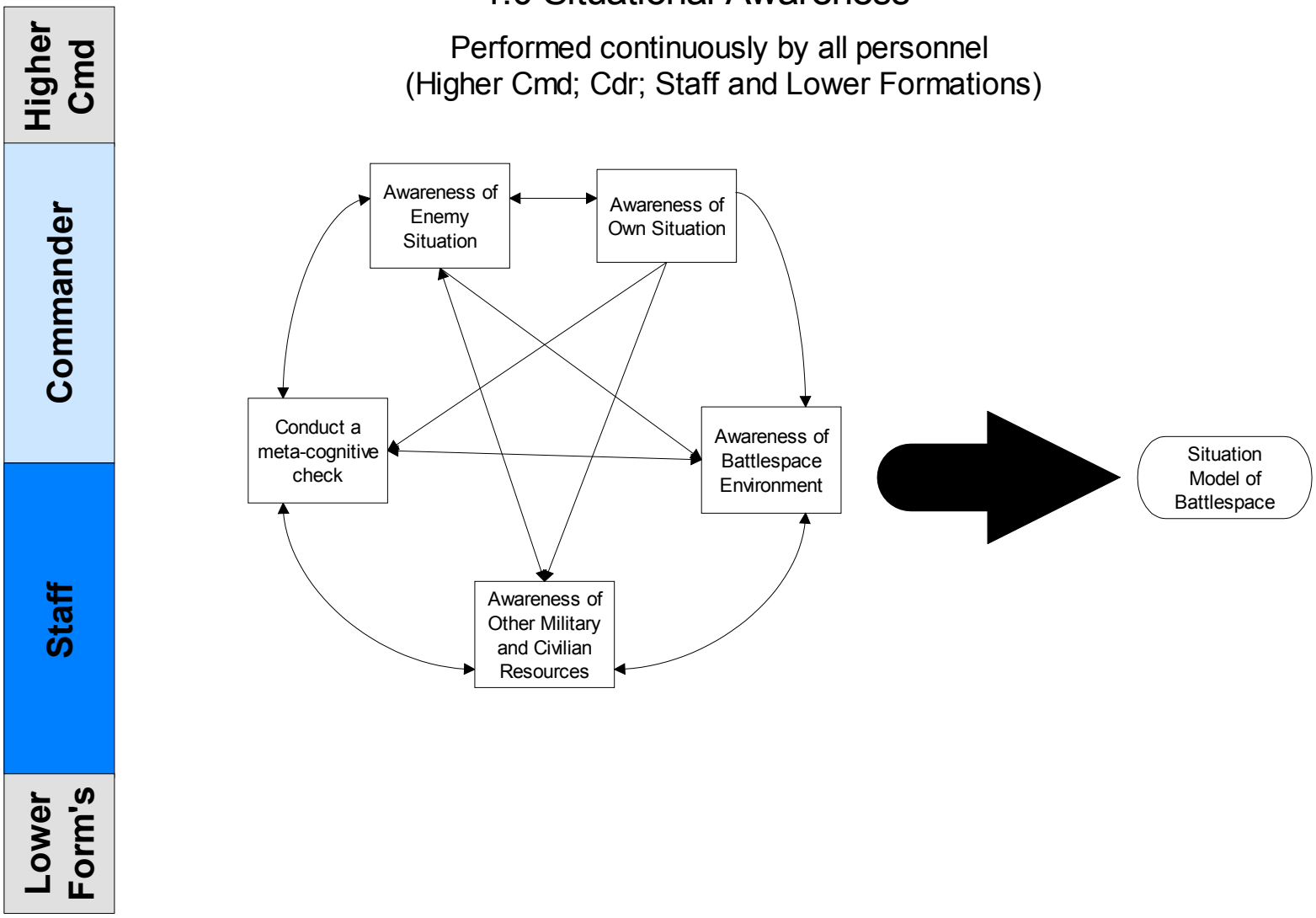
Annex F: Swimlane OPP & IOPP Diagrams

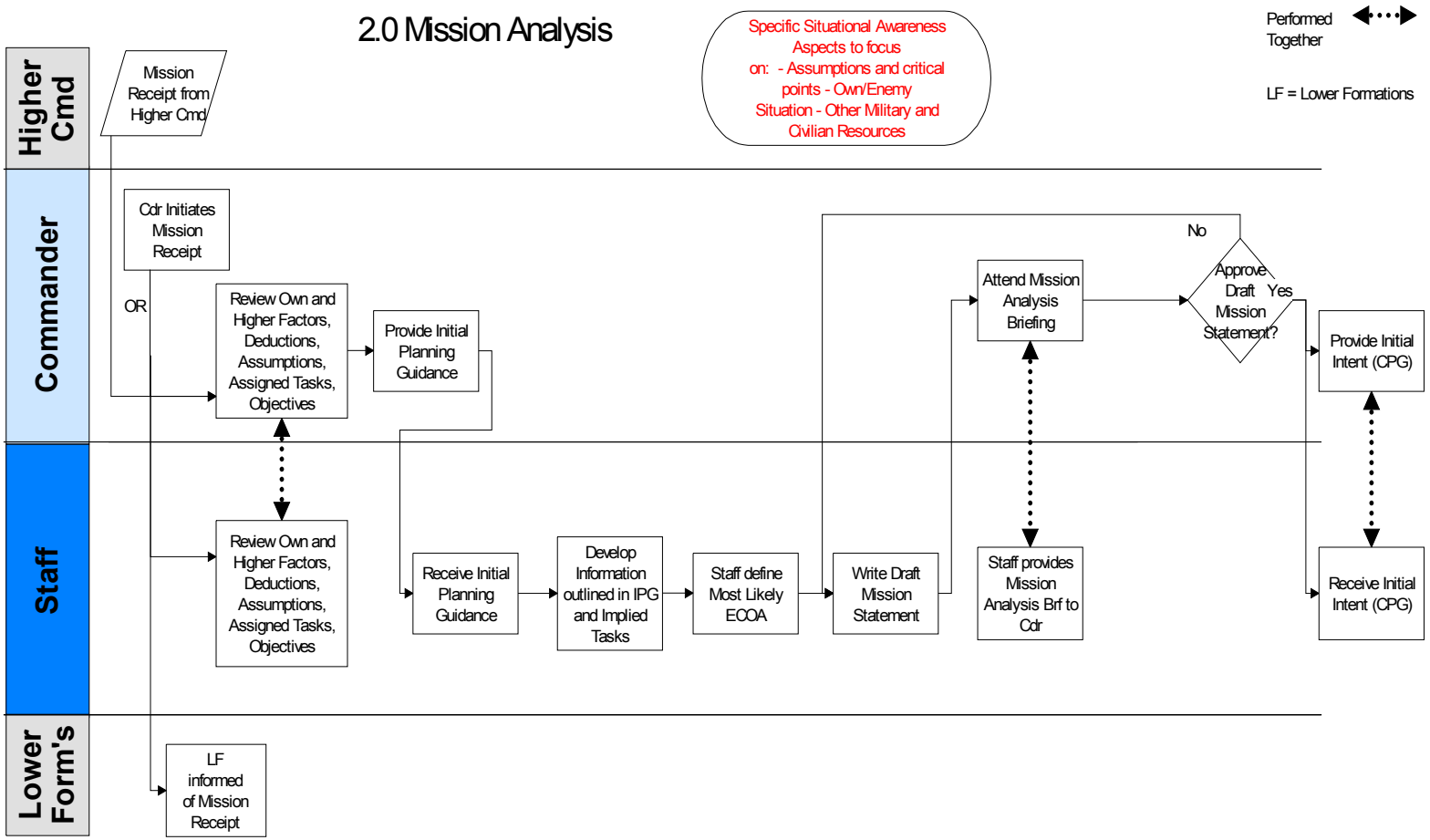
Intuitive Operations Planning Process (IOPP)



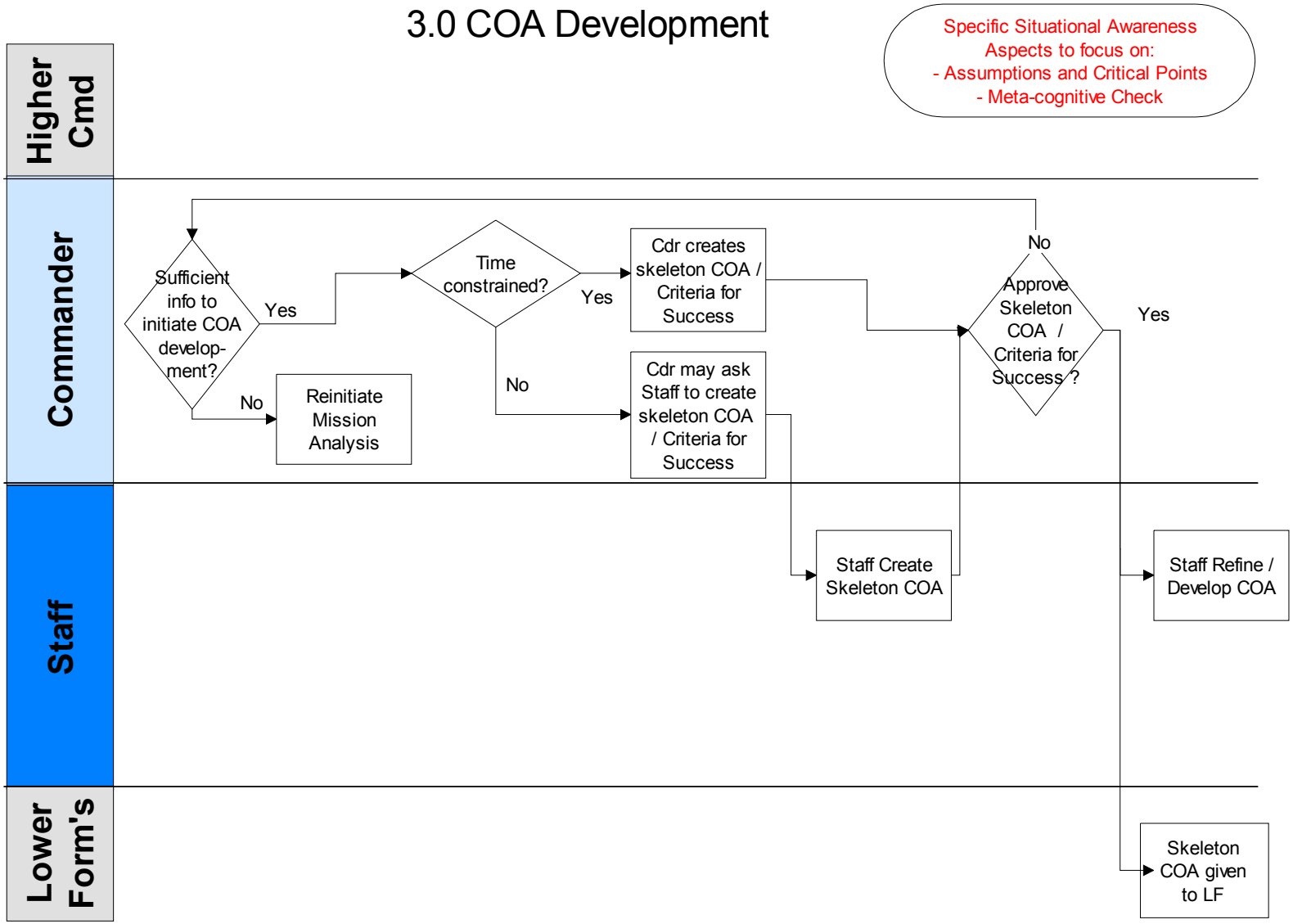
1.0 Situational Awareness

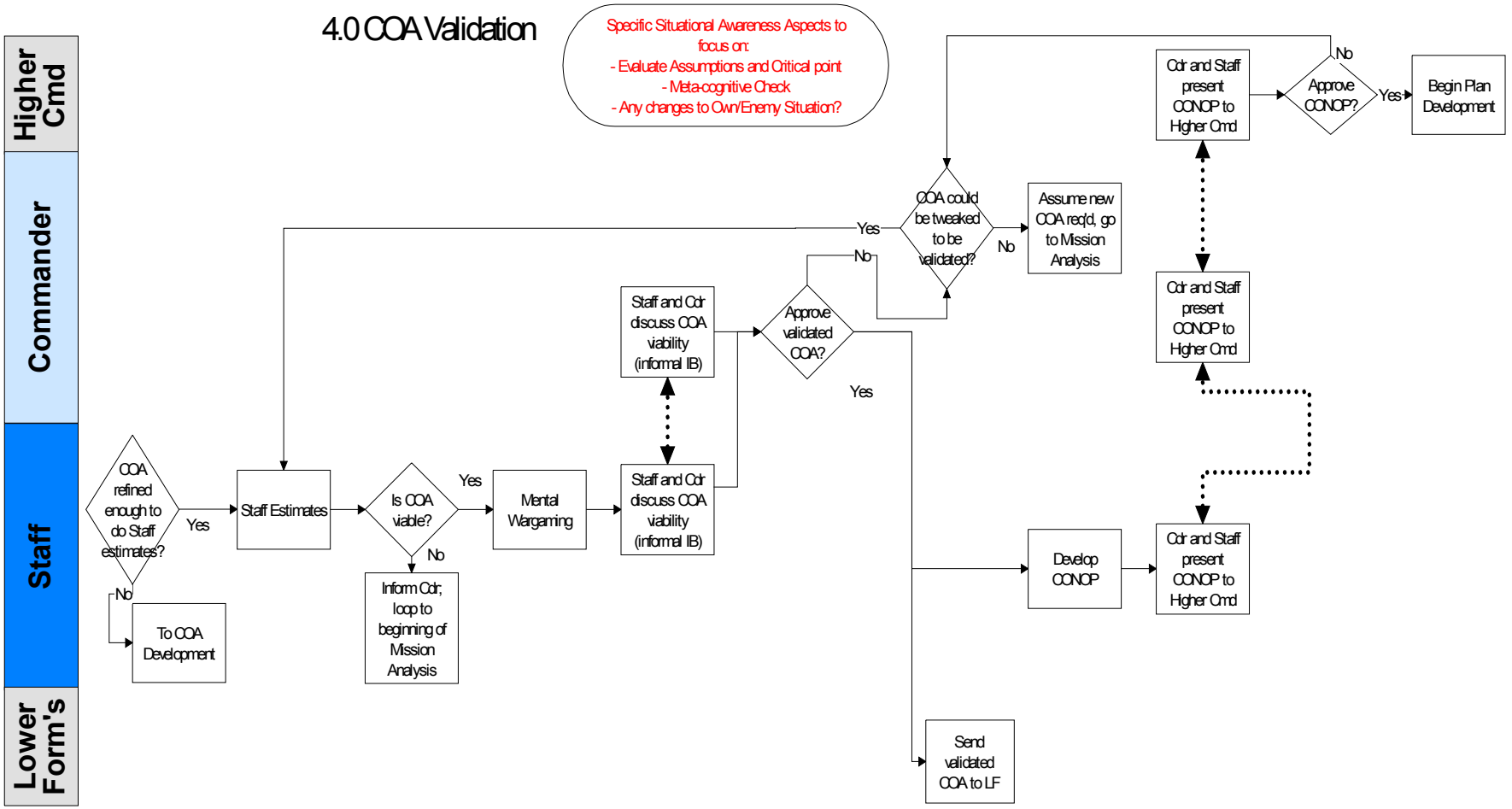
Performed continuously by all personnel
(Higher Cmd; Cdr; Staff and Lower Formations)

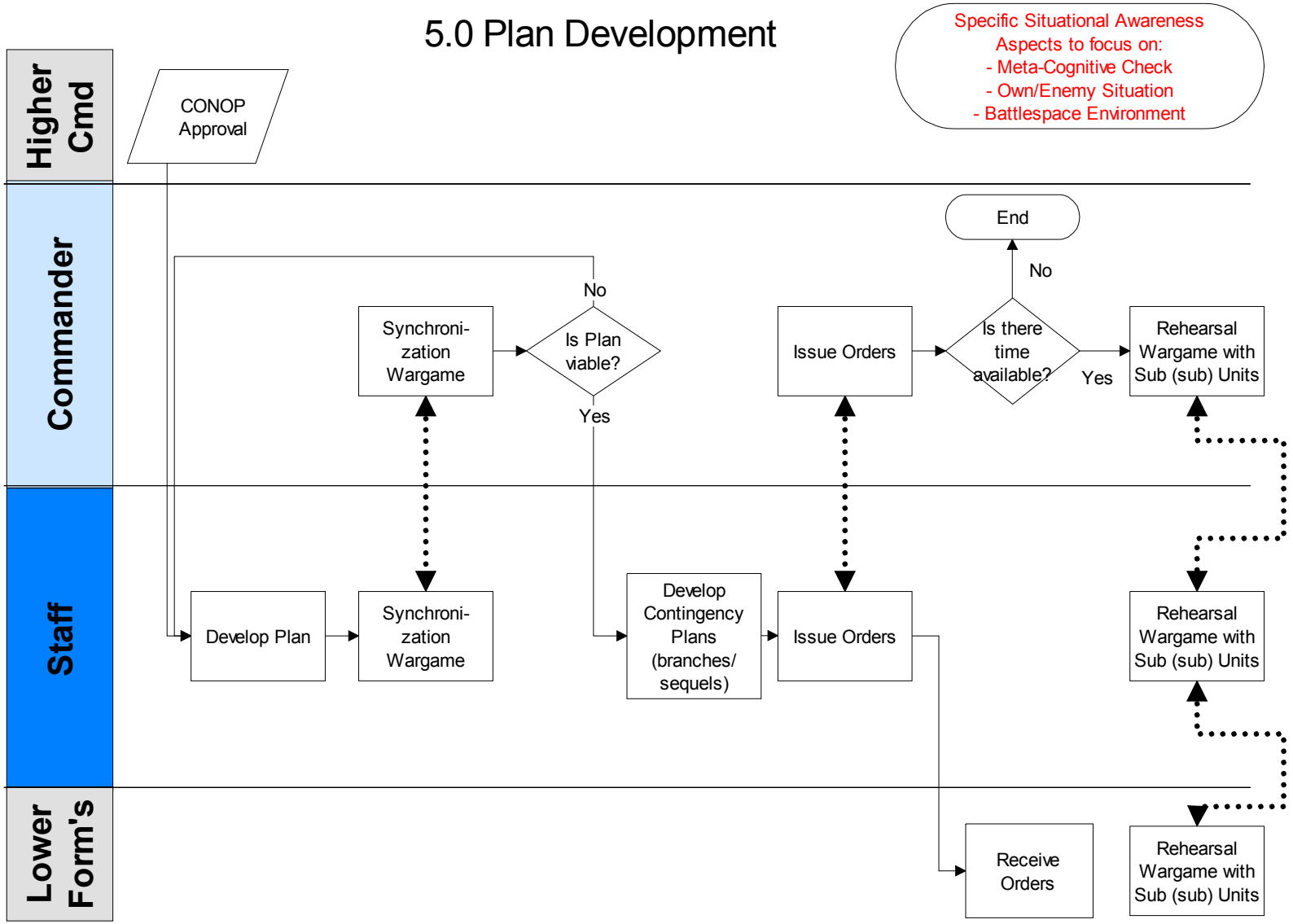



2.0 Mission Analysis
Specific Situational Awareness Aspects to focus on: - Assumptions and critical points - Own/Enemy Situation - Other Military and Civilian Resources
Performed Together
LF = Lower Formations
Higher Cmd
Commander
Staff
Lower Form's
Mission Receipt from Higher Cmd
Cdr Initiates Mission Receipt
OR
Review Own and Higher Factors, Deductions, Assumptions, Assigned Tasks, Objectives
Provide Initial Planning Guidance
Review Own and Higher Factors, Deductions, Assumptions, Assigned Tasks, Objectives
Receive Initial Planning Guidance
Develop Information outlined in IPG and Implied Tasks
Staff define Most Likely ECOA
Write Draft Mission Statement
Attend Mission Analysis Briefing
Staff provides Mission Analysis Brf to Cdr
Approve Draft Mission Statement?
No
Yes
Provide Initial Intent (CPG)
Receive Initial Intent (CPG)
LF informed of Mission Receipt

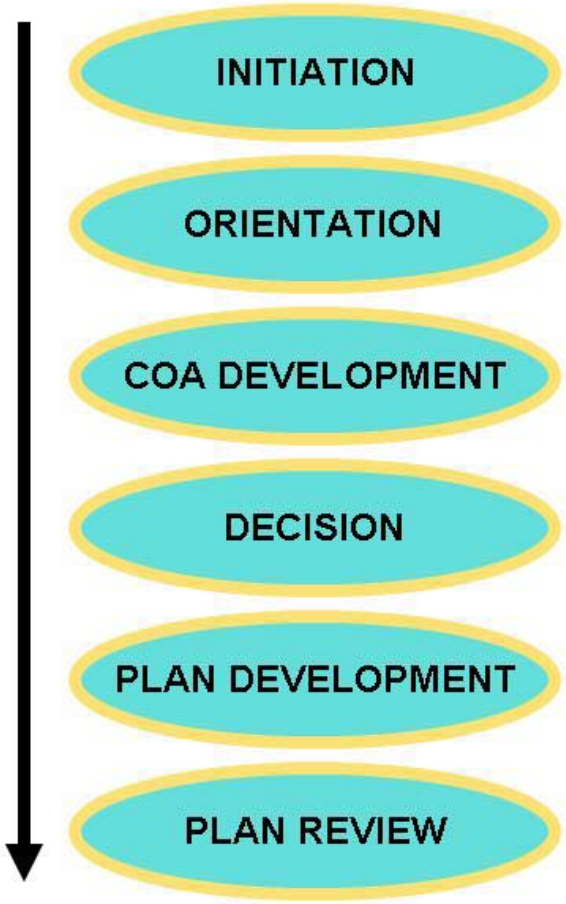
3.0 COA Development

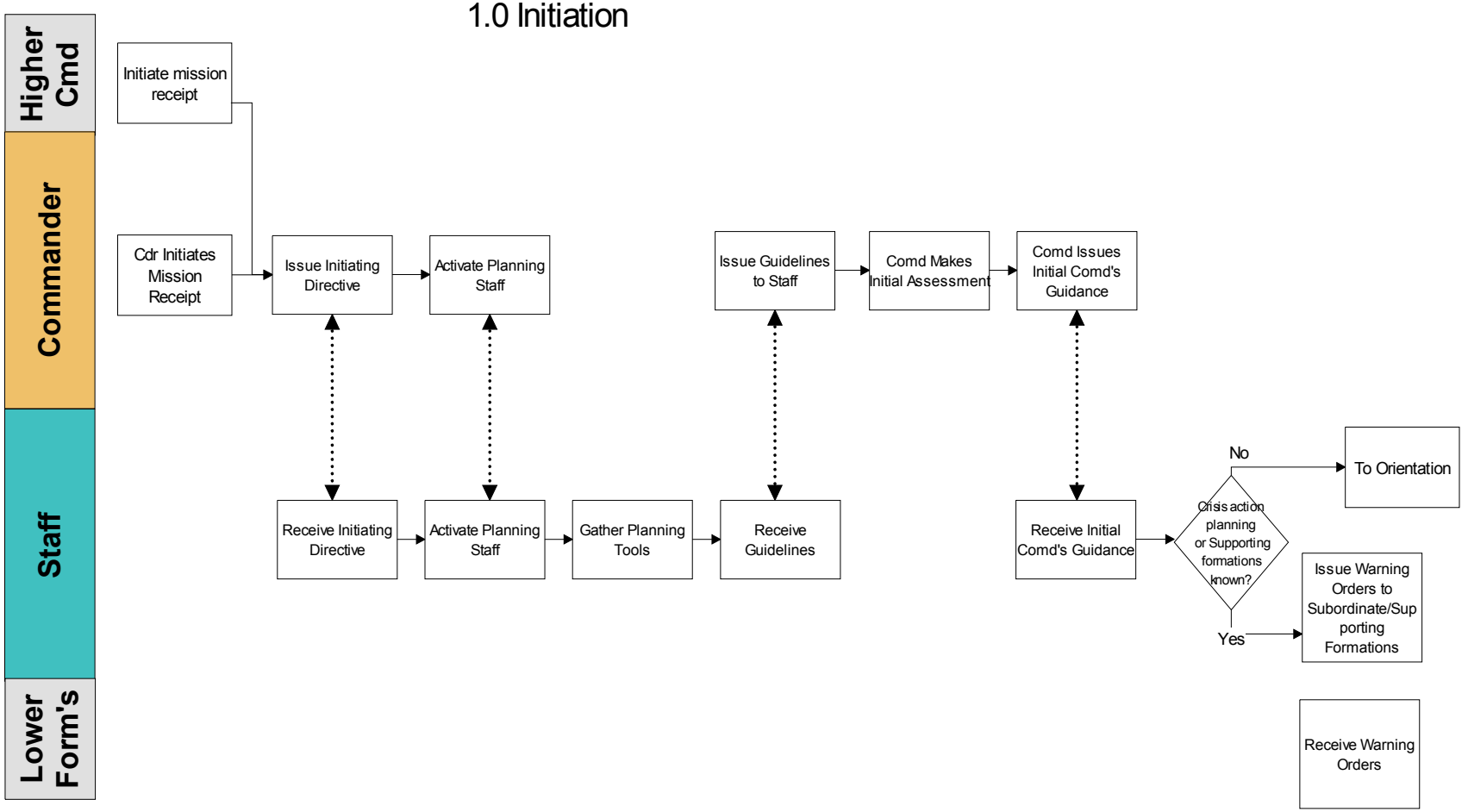



4.0 COA Validation
Specific Situational Awareness Aspects to focus on:
- Evaluate Assumptions and Critical point
- Meta-cognitive Check
- Any changes to Own/Enemy Situation?
Higher Cmd
Commander
Staff
Lower Form's
COA refined enough to do Staff estimates?
Yes
No
To COA Development
Staff Estimates
Is COA viable?
Yes
No
Inform Cdr; loop to beginning of Mission Analysis
Mental Wargaming
Staff and Cdr discuss COA viability (informal IB)
Staff and Cdr discuss COA viability (informal IB)
Approve validated COA?
No
Yes
COA could be tweaked to be validated?
Yes
No
Assume new COA reqd, go to Mission Analysis
Develop CONOP
Send validated COA to LF
Cdr and Staff present CONOP to Higher Cmd
Cdr and Staff present CONOP to Higher Cmd
Cdr and Staff present CONOP to Higher Cmd
Approve CONOP?
No
Yes
Begin Plan Development

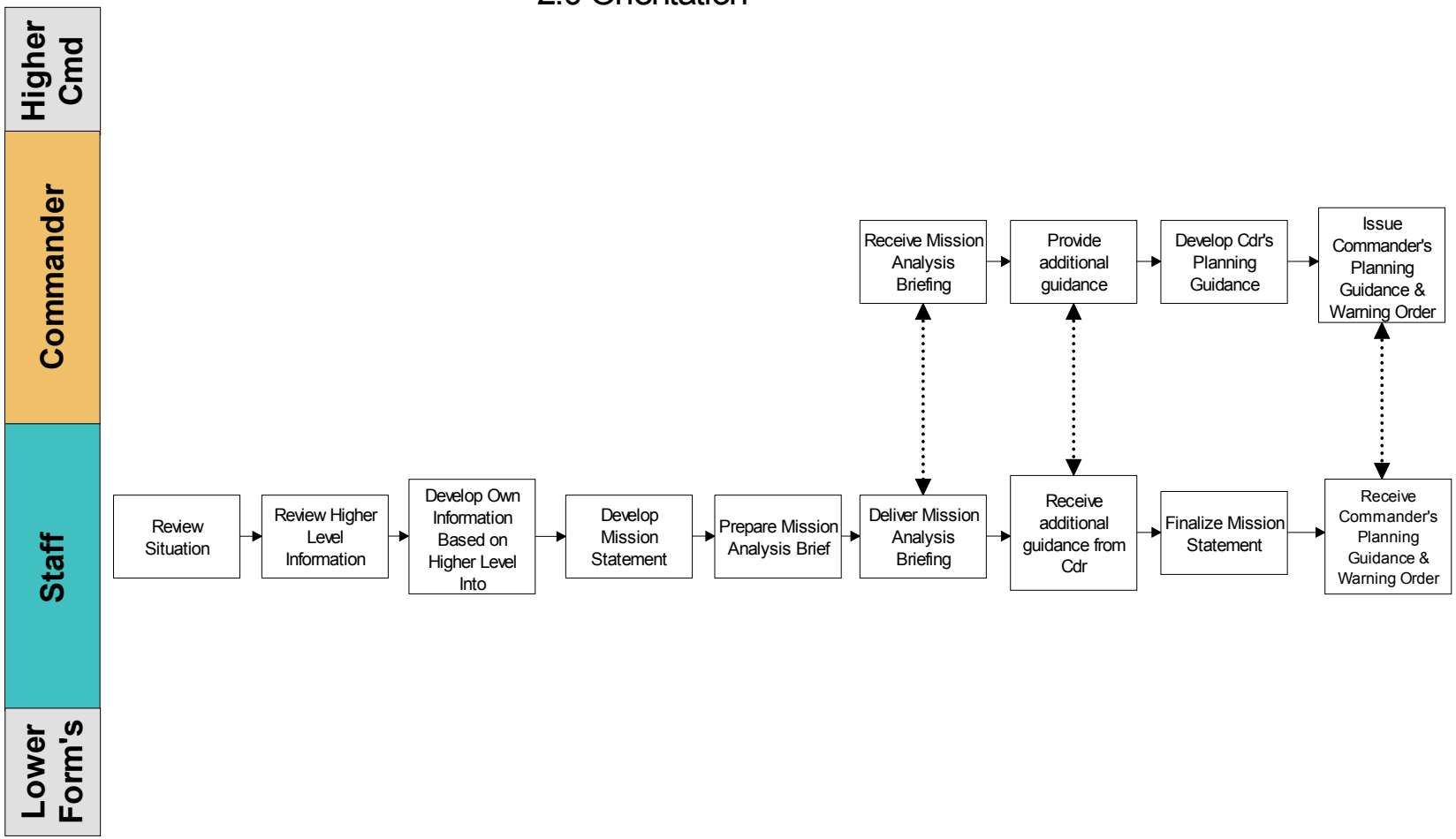

5.0 Plan Development
Specific Situational Awareness
Aspects to focus on:
- Meta-Cognitive Check
- Own/Enemy Situation
- Battlespace Environment
Higher Cmd
Commander
Staff
Lower Form's
CONOP Approval
Develop Plan
Synchroni-zation Wargame
Is Plan viable?
No
Yes
Develop Contingency Plans (branches/ sequels)
Issue Orders
Is there time available?
No
Yes
End
Rehearsal Wargame with Sub (sub) Units
Rehearsal Wargame with Sub (sub) Units
Rehearsal Wargame with Sub (sub) Units
Receive Orders

Overview of OPP

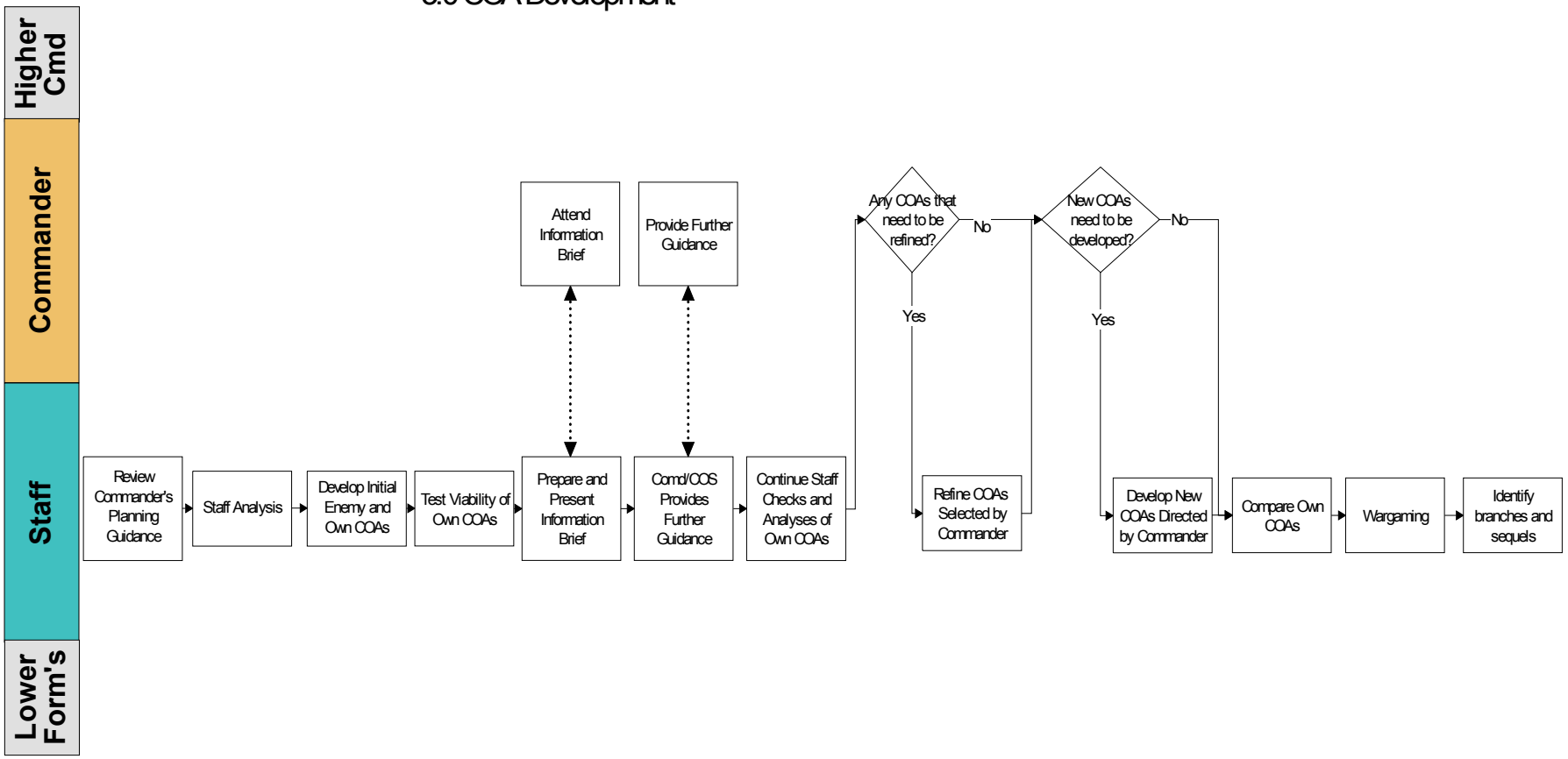



1.0 Initiation
Higher Cmd
Commander
Staff
Lower Form's
Initiate mission receipt
Cdr Initiates Mission Receipt
Issue Initiating Directive
Activate Planning Staff
Issue Guidelines to Staff
Comd Makes Initial Assessment
Comd Issues Initial Comd's Guidance
Receive Initiating Directive
Activate Planning Staff
Gather Planning Tools
Receive Guidelines
Receive Initial Comd's Guidance
Crisis action planning or Supporting formations known?
No
To Orientation
Yes
Issue Warning Orders to Subordinate/Supporting Formations
Receive Warning Orders

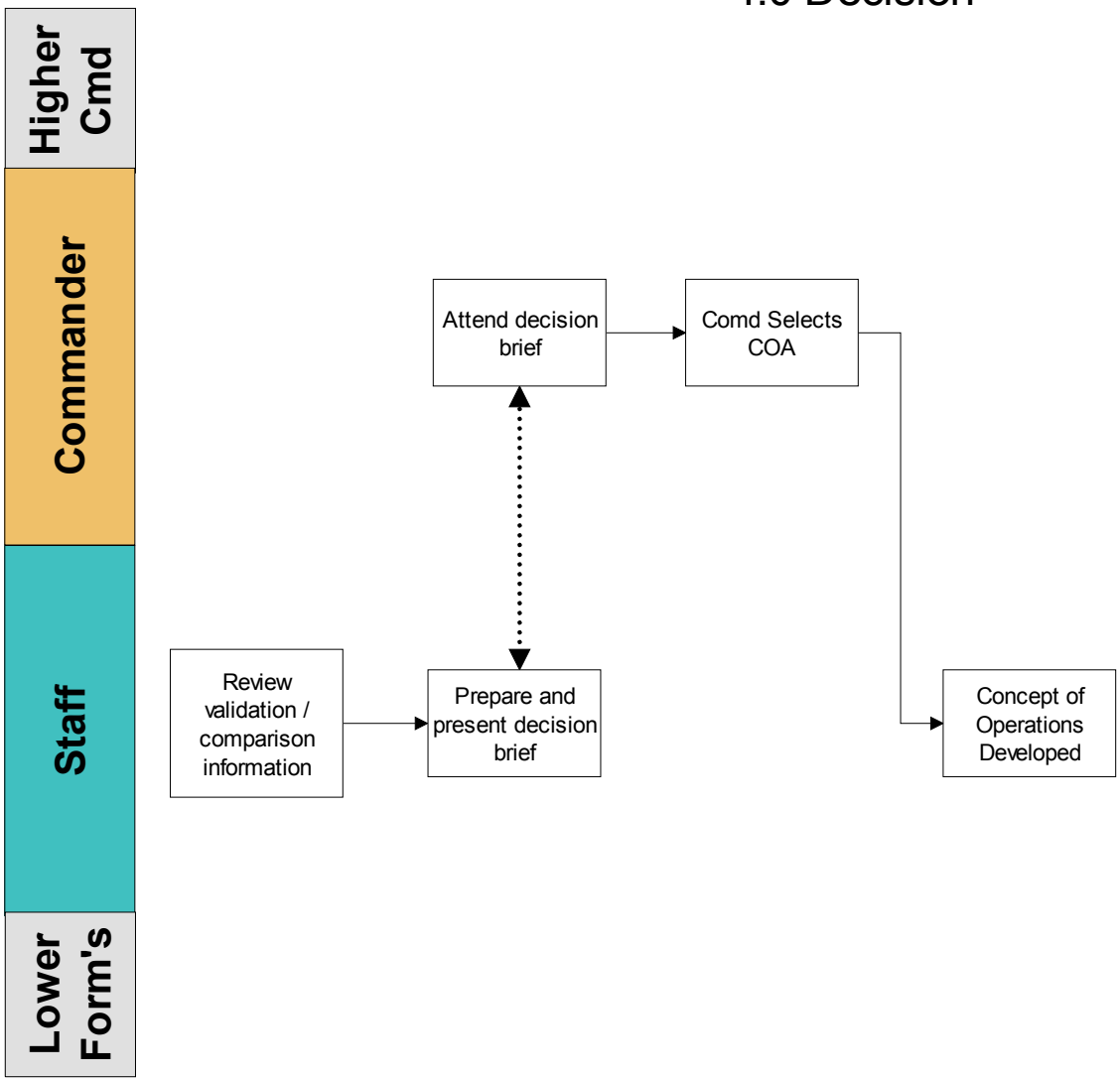
2.0 Orientation

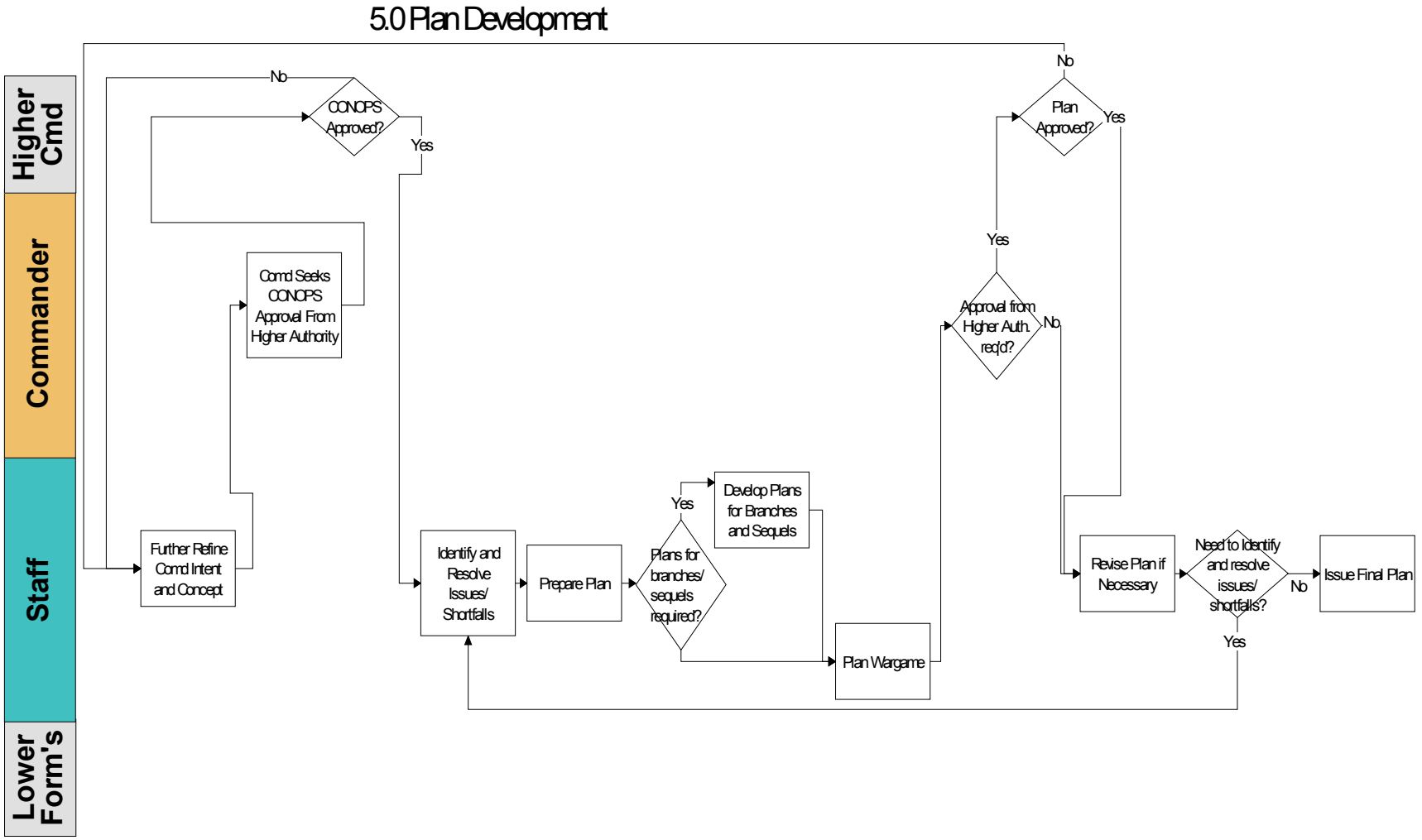


3.0 COA Development

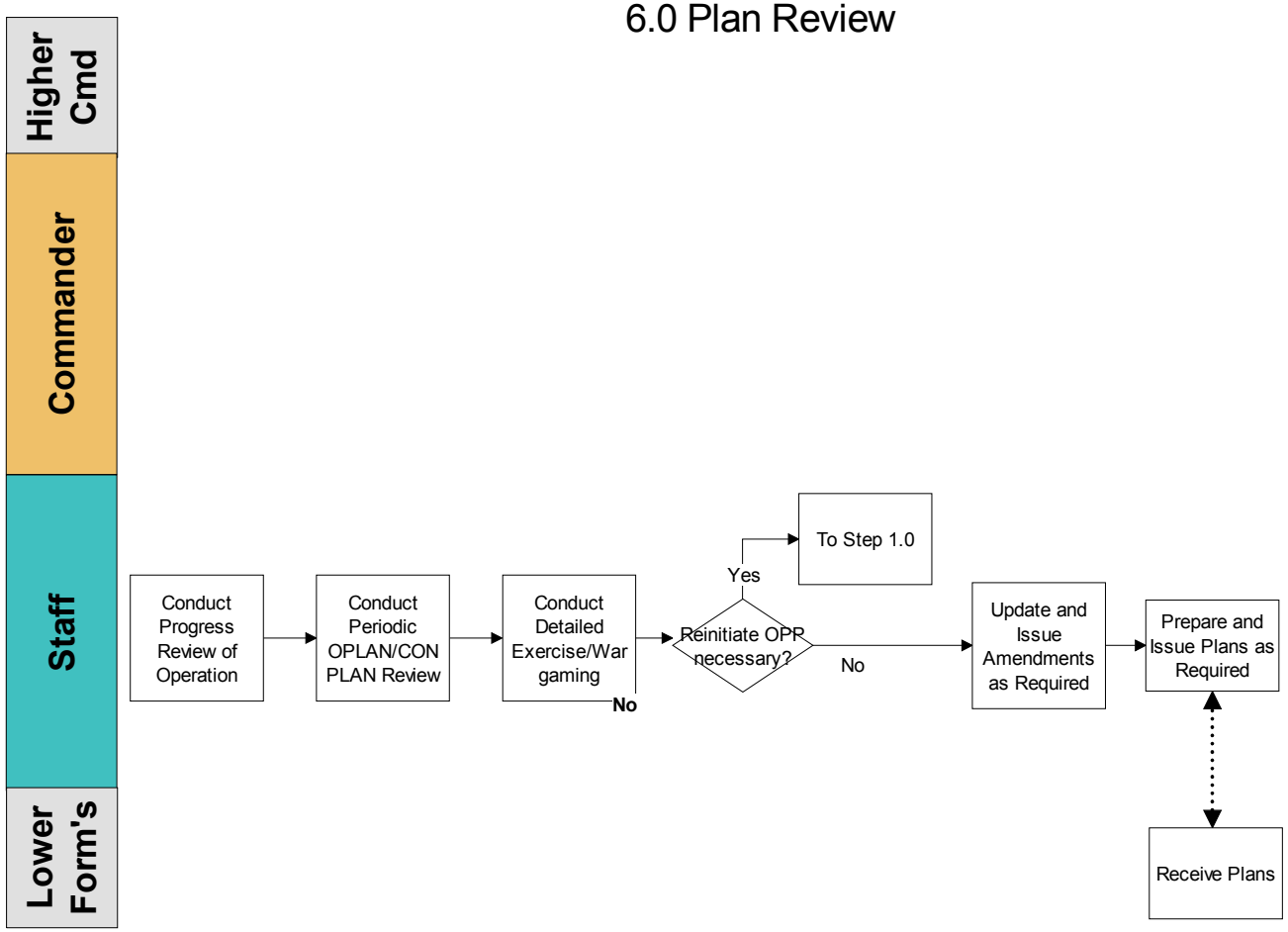


4.0 Decision


Higher Cmd
Commander
Staff
Lower Form's
Attend decision brief
Comd Selects COA
Review validation / comparison information
Prepare and present decision brief
Concept of Operations Developed


5.0 Plan Development
Higher Cmd
Commander
Staff
Lower Form's
No
CONOPS Approved?
Yes
Cmd Seeks CONOPS Approval From Higher Authority
Further Refine Cmd Intent and Concept
Identify and Resolve Issues/ Shortfalls
Prepare Plan
Yes
Plans for branches/ sequels required?
Develop Plans for Branches and Sequels
Plan Wargame
Approval from Higher Auth. req'd?
Yes
No
No
Plan Approved?
Yes
Revise Plan if Necessary
Need to Identify and resolve issues/ shortfalls?
No
Issue Final Plan
Yes

6.0 Plan Review



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Annex G: Sequence of OPP & IOPP Steps Performed

IOPP Yellow, Day 1		IOPP Blue, Day 2		OPP Blue, Day 1		OPP Yellow, Day 2	
2.1	Mission Receipt	2.1	Mission Receipt	1.1	Mission Receipt	1.1	Mission Receipt
Not in IOPP	Review of players' roles	Not in IOPP	Review IOPP	1.4	Gather Planning Tools	1.2	Issue Initiating Directive
1.3	Awareness of Battlespace Environment	1.1	Awareness of Enemy Situation	1.2	Issue/receive initiating directive	1.4	Gather Planning Tools
1.1	Awareness of Enemy Situation	1.4	Awareness of Other Military and Civilian Resources	1.4	Gather Planning Tools	Not in OPP	Preparing Initial Comd's Guidance
1.3	Awareness of Battlespace Environment	1.3	Awareness of Battlespace Environment	1.5	Comd issues guidelines	1.4	Gather Planning Tools
2.2	Review factors	2.4	Impied Tasks	Not in OPP	Preparing Initial Comd's Guidance	1.5	Comd issues Guidelines
1.3	Awareness of Battlespace Environment	1.3	Awareness of Battlespace Environment	2.1	Review situation	1.6	Comd makes initial assessment (timing)
Not in IOPP	Review of players' roles	2.4	Impied Tasks	1.4	Gather Planning Tools	1.4	Gather Planning Tools
Not in IOPP	Understanding met-cog check	2.6	Staff Write Draft Mission Statement	2.2	Review Higher Level Information	2.1	Staff review situation
1.3	Awareness of Battlespace Environment	1.3	Awareness of Battlespace Environment	1.4	Gather Planning Tools	1.7	Initial Comd's Guidance
1.2	Awareness of Own Situation	2.2	Comd reviewing factors	1.7	Initial Comd's Guidance	1.6	Comd makes initial assessment (timing)

IOPP Yellow, Day 1		IOPP Blue, Day 2		OPP Blue, Day 1		OPP Yellow, Day 2	
2.3	Comd gives planning guidance	1.3	Awareness of Battlespace Environment	1.6	Comd makes initial assessment (timings)	2.1	Staff review situation
Not in IOPP	Understanding met-cog check	Not in IOPP	As Comd is reviewing factors and notices something that may be of importance to a particular member of his staff he draws their attention to it	1.7	Initial Comd's Guidance	2.2	Review higher level info
1.4	Awareness of Military and Civilian Resources	2.4	Impied Tasks	2.1	Review own situation	2.3	Develop own info based on higher level info
1.3	Awareness of Battlespace Environment	2.2	Review factors	2.2	Review Higher Level Information	2.4	Staff develop Mission Statement
Not in IOPP	Understanding met-cog check	2.3	Initial Planning Guidance	2.3	Develop own information based on higher level info	3.3	Develop Enemy COA
2.2	Review Factors	1.3	Awareness of Battlespace Environment	2.4	Develop mission statement	2.4	Staff develop Mission Statement
1.4	Awareness of Military and Civilian Resources	1.1	Awareness of Enemy Situation	2.1	Review Situation	2.3	Develop own info based on higher level info
1	Situational Awareness	1.2	Awareness of Own Situation	2.5	Prepare mission analysis brief	3.2	Staff Analysis
Not in IOPP	Review of players' roles	1.4	Awareness of Other Military and Civilian Resources	2.1	Review Situation	3.3	Develop Initial Enemy and Own COAs

IOPP Yellow, Day 1		IOPP Blue, Day 2		OPP Blue, Day 1		OPP Yellow, Day 2	
1.4	Awareness of Military and Civilian Resources	2.2	Comd reviewing factors	2.2	Review Higher Level Information	2.5	Prepare Mission Analysis Brief
1.5	Meta-cog check	1.1	Awareness of Enemy Situation	2.3	Develop own information based on higher level info	2.6	Mission Analysis Briefing
2.2	Review factors	3.2.2.1	Staff Working on Skeleton COA	1.6	Modify initial assessment (timings)	2.7	Additional guidance by Comd
2.3	Comd gives planning guidance	1.3	Awareness of Battlespace Environment	2.1	Review Situation	2.9	Finalize mission statement
1.4	Awareness of Military and Civilian Resources	Not in IOPP	Comd discussing with Higher Comd (Kent) E COA	1.6	Modify initial assessment (timings)	2.8	Comd develops Comd's planning guidance
2.5	Define most likely ECOA	1.5	Conduct meta-cog check	2.3	Develop own information based on higher level info	2.10	CPG
2.3	Comd gives planning guidance	1.3	Awareness of Battlespace Environment	2.6	Mission Analysis Briefing	2.9	Finalize mission statement
1.1	Awareness of Own Situation	2.3	Initial Planning Guidance	2.10	Comd's Planning Guidance	2.10	CPG
1.5	Conduct meta-cog check	1.1	Awareness of Enemy Situation	2.7	Comd gives additional guidance	3.1	Staff review CPG
2.3	Comd gives planning guidance	1.2	Awareness of Enemy Situation	3.3	Develop Initial Enemy and Own COAs	3.2	Staff Analysis
2.2	Review factors	2.2	Review factors	3.2	Staff Analysis	3.3	Develop Initial Enemy and Own COAs
2.3	Comd gives planning guidance	3.2.1	Comd thinking about Skeleton COA	3.3	Develop Initial Enemy and Own COAs	3.5	Information Brief

IOPP Yellow, Day 1		IOPP Blue, Day 2		OPP Blue, Day 1		OPP Yellow, Day 2	
1	Situational Awareness	2.6	Staff working on draft mission statement	3.5	Information Brief	3.6	Comd provides further guidance
2.2	Review Assumptions	2.7	Mission Analysis Briefing	3.6	Comd provides further guidance	3.8	Comd decides if COAs need to be refined
2.3	Comd gives planning guidance	1.5	Conduct meta-cog check	3.5	Information Brief	3.9	Refine COAs
2.4	Develop Info Outlined in IPG and Implied Tasks	2.5	Staff define most likely E COA (during mission analysis briefing)	3.8	COAs need to be refined?	3.11	Develop new COAs as directed by Comd
1.3	Awareness of Battlespace Environment	Not in IOPP	Staff and Comd develop Skeleton COA	3.7	Staff continue checks and analyses of own COA	3.13	Staff Wargame
2.4	Develop Info Outlined in IPG and Implied Tasks	2.2	Review Assumptions	3.13	Staff Wargame	3.9	Refine COAs
1.3	Awareness of Battlespace Environment	2.8	Comd approves Mission Statement	3.14	Identify branches and sequels	4.1	Review validation/comparison information
2.5	Define most likely ECOA	1.5	Conduct meta-cog check	3.9	Refine COAs	4.2	Decision Brief
1.3	Awareness of Battlespace Environment	3.2.1	Comd provides Skeleton COA	3.12	Compare own COAs	4.3	Comd selects COA
1.5	Conduct meta-cog check	Not in IOPP	Comd provides alternative COA	4.2	Decision Brief	5.1	Staff further refines Comd intent and concept
2.2	Review Assigned Tasks	1.5	Conduct meta-cog check	4.3	Comd selects COA	5.2	Comd seeks CONOP approval

IOPP Yellow, Day 1		IOPP Blue, Day 2		OPP Blue, Day 1		OPP Yellow, Day 2	
2.4	Develop Info Outlined in IPG and Implied Tasks	4.4	Mental Wargaming	5.5	Prepare plan	5.3	Higher Comd approves of CONOP
1.2	Awareness of Own Situation	3.4	Refine/develop COA	5.13	Issue Final Plan	5.4	Identify and resolve issues/shortfalls
1.3	Awareness of Battlespace Environment	Not in IOPP	Comd preparing for CPG			5.5	Prepare Plan
1.5	Meta-cog check	2.4	Develop info outlined in IPG and Implied Tasks with reference to alternative COA			5.13	Issue Final Plan
1.3	Awareness of Battlespace Environment	2.9	Comd provides Initial Intent				
2.2	Review factors	3.2.1	Comd gives Criteria for Success				
2.5	Define most likely ECOA	1	Situational Awareness				
1.4	Awareness of Military and Civilian Resources	4.9	Comd gives CONOP				
2.5	Define most likely ECOA	1.5	Conduct meta-cog check				
Not in IOPP	Review IOPP	3.4	Refine/develop COA				
2.5	Define most likely ECOA	4.4	Mental Wargaming				
2.6	Write draft mission statement	4.2	Staff Estimates				

IOPP Yellow, Day 1		IOPP Blue, Day 2		OPP Blue, Day 1		OPP Yellow, Day 2	
1.4	Awareness of Military and Civilian Resources	1.5	Conduct meta-cog check				
Not in IOPP	Review of players' roles	4.4	Mental Wargaming				
Not in IOPP	Discussion of attack (remember this is a defensive scenario)	4.7	Tweaking of COA				
Not in IOPP	Review IOPP	4.4	Mental Wargaming				
2.4	Develop Info Outlined in IPG and Implied Tasks	1.5	Conduct meta-cog check				
1.4	Awareness of Military and Civilian Resources	4.4	Mental Wargaming				
2.5	Define most likely ECOA	4.7	Tweaking of COA				
1.4	Awareness of Military and Civilian Resources	4.4	Mental Wargaming				
3.2.1	Comd gives Skeletoon COA	4.6	Comd approves validated COA				
2.7	Mission Analysis Briefing	4.10	CONOP to higher Comd				
1	Situational Awareness	4.8	Validation briefing				
2.9	Comd provides Initial Intent (CPG)	5.5	Orders				
3.2.1	Comd gives Skeletoon COA						

IOPP Yellow, Day 1		IOPP Blue, Day 2		OPP Blue, Day 1		OPP Yellow, Day 2	
2.8	Comd approves of Draft Mission Statement						
3.2.1	Comd gives Skeletoon COA						
3.4	Refine/Develop COA						
2.5	Define Most Likely ECOA						
3.4	Refine/Develop COA						
1.4	Awareness of Other Military and Civilian Resources						
3.4	Refine/Develop COA						
1.3	Awareness of Battlespace Environment						
3.4	Refine/Develop COA						
Not in IOPP	Cmdr asks for progress check						
3.2.1	Comd gives Criteria for Success						
3.5	Finalize COA						
1.5	Conduct meta-cog check						
4.2	Staff Estimates						
4.3	Is COA viable?						
4.2	Staff Estimates						

IOPP Yellow, Day 1		IOPP Blue, Day 2		OPP Blue, Day 1		OPP Yellow, Day 2	
4.4	Mental Wargaming						
4.5	Staff and Comd discuss COA viability						
4.4	Mental Wargaming						
4.6	COA Validated						
`4.10	CONOP						
5.1	Develop Plan						
5.4	Conitingency Plans						
5.1	Develop Plan						
5.5	Orders						

Annex H: Participants Ratings of Planning Products and Process

name	date	1easeofuse	2learnability	3efficiency	4effectivenes	5complexity	6suitability	7usersatisf	8usertrust	9reliability
Welsh	19-Feb	3	2	3	4	2	1	4	4	4
Robertson	19-Feb	3	3	4	4	3	4	5	5	5
Kellock	19-Feb	3	3	4	4	2	4	4	5	5
Hall	19-Feb	3	3	4	3	2	3	2	3	3
Stewart	19-Feb	3	3	2	3	2	3	3	3	4
Alo	*Incomplete*									
Bryden	19-Feb	4	4	4	3	4	3	4	2	3
Van Der Sluis	19-Feb	3	3	4	4	3	5	5	5	4
Oneil	19-Feb	4	4	5	4	4	5	4	4	4
Fitzgerald	19-Feb	4	4	4	4	3	4	4	3	4
McMahon	19-Feb	4	4	4	3	4	4	4	3	3
Johnston	19-Feb	2	3	4	4	2	4	4	4	4

name	date	10errorpotential	11errorcriticality	12suitvarietyops	13trustcompmsn	14relycompmsn	15accuracy	16quality	17realismscen	18realismtime	19degree
Welsh	19-Feb	2	3	2	4	4	4	3	2	5	4
Robertson	19-Feb	4	4	4	4	5	4	4	4	4	4
Kellock	19-Feb	4	3	5	4	5	5	5	5	4	5
Hall	19-Feb	3	3	3	3	3	3	3	4	4	4
Stewart	19-Feb	4	4	3	3	4	4	4	5	4	3
Alo	*Incomplete*										
Bryden	19-Feb	2	3	2	3	3	3	3	5	5	4
Van Der Sluis	19-Feb	4	3	5	5	5	4	4	5	5	4
Oneil	19-Feb	4	3	4	4	4	5	4	3	3	4
Fitzgerald	19-Feb	3	2	3	4	4	3	3	4	4	4
McMahon	19-Feb	3	3	4	3	4	4	4	4	4	4
Johnston	19-Feb	2	2	4	4	4	4	3	4	3	4

Annex I: Participant Workload Ratings

name	date	scenario	group	role	mental	phys	temporal	perform	effort	frustration
Welsh	19-Feb	Offense	OPP	Comd	6.5	5.5	5.0	2.5	5.5	5.0
Robertson	19-Feb	Offense	OPP	Ops O	7.0	7.0	8.0	3.0	7.0	3.0
Kellock	19-Feb	Offense	OPP	Int Officer	3.0	1.0	4.0	2.0	5.0	3.0
Hall	19-Feb	Offense	OPP	Engineer	6.5	2.0	7.0	1.5	6.0	2.0
Stewart	19-Feb	Offense	OPP	Fires	6.0	4.5	6.5	3.5	6.0	3.5
Alo	*Incomplete*									
Bryden	19-Feb	B	IOPP	Comd	8.5	1.0	2.0	2.0	5.0	2.0
Van Der Sluis	19-Feb	B	IOPP	Ops O	5.5	4.0	4.5	0.5	6.0	0.5
Oneil	19-Feb	Ex King Cobra	IOPP	Int Officer	7.5	3.5	5.5	7.0	6.5	5.5
Fitzgerald	19-Feb	B	IOPP	Asst Ops O	6.5	2.0	6.5	2.5	5.5	2.5
McMahon	19-Feb		IOPP	Fires	6.0	1.5	5.5	2.0	6.5	3.0
Johnston	19-Feb	B	IOPP	CIMIC/Ops	5.0	2.0	5.0	2.0	3.0	3.0

name	date	eff-perf	temp-frus	temp-eff	phys-frus	perf-frus	phys-temp	phys-perf	temp-ment
Welsh	19-Feb	2	1	1	2	1	2	2	2
Robertson	19-Feb	2	1	1	1	1	2	2	2
Kellock	19-Feb	2	2	1	2	1	2	2	2
Hall	19-Feb	1	1	1	1	1	2	2	1
Stewart	19-Feb	1	1	1	2	1	2	2	2
Alo	*Incomplete*								
Bryden	19-Feb	2	1	1	1	1	1	2	2
Van Der Sluis	19-Feb	1	1	2	2	1	2	2	2
Oneil	19-Feb	2	2	1	2	2	2	2	2
Fitzgerald	19-Feb	2	1	1	2	1	2	2	1
McMahon	19-Feb	2	1	2	2	1	2	2	2
Johnston	19-Feb	2	1	2	2	1	2	2	2

name	date	frus-eff	perf-ment	perf-temp	ment-eff	ment-phys	eff-phys	frus-ment
Welsh	19-Feb	2	1	1	2	1	1	2
Robertson	19-Feb	2	2	2	1	1	2	2
Kellock	19-Feb	1	1	1	1	1	1	2
Hall	19-Feb	2	2	2	1	1	1	2
Stewart	19-Feb	2	2	2	1	1	1	1
Alo	*Incomplete*							
Bryden	19-Feb	2	2	1	1	1	1	2
Van Der Sluis	19-Feb	2	2	1	2	1	1	2
Oneil	19-Feb	1	2	2	1	1	1	1
Fitzgerald	19-Feb	1	2	2	1	1	1	2
McMahon	19-Feb	2	1	1	2	1	1	2
Johnston	19-Feb	2	1	1	1	1	1	2

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Publishing: DRDC Toronto

Performing: Humansystems© Incorporated, 111 Farquhar St., 2nd floor, Guelph, ON N1H 3N4

Monitoring:

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DEVELOPMENT AND EVALUATION OF AN INTUITIVE OPERATIONS PLANNING PROCESS (U)
ÉLABORATION ET ÉVALUATION D'UN PROCESSUS DE PLANIFICATION INTUITIVE DES OPÉRATIONS

4. AUTHORS (First name, middle initial and last name. If military, show rank, e.g. Maj. John E. Doe.)

Lora Bruyn Martin; Farahnaz Bandali; Lisa Rehak; Robert Vokac; Tab Lamoureux

5. DATE OF PUBLICATION (Month and year of publication of document.)

May 2006

6a NO. OF PAGES (Total containing information, including Annexes, Appendices, etc.)

144

6b. NO. OF REFS (Total cited in document.)

14

7. DESCRIPTIVE NOTES (The category of the document, e.g. technical report, technical note or memorandum. If appropriate, enter the type of document, e.g. interim, progress, summary, annual or final. Give the inclusive dates when a specific reporting period is covered.)

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9a. PROJECT OR GRANT NO. (If appropriate, the applicable research and development project or grant under which the document was written. Please specify whether project or grant.)

12od02

9b. CONTRACT NO. (If appropriate, the applicable number under which the document was written.)

W7711−047943/001/TOR

10a. ORIGINATOR'S DOCUMENT NUMBER (The official document number by which the document is identified by the originating activity. This number must be unique to this document)

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13. ABSTRACT (A brief and factual summary of the document. It may also appear elsewhere in the body of the document itself. It is highly desirable that the abstract of classified documents be unclassified. Each paragraph of the abstract shall begin with an indication of the security classification of the information in the paragraph (unless the document itself is unclassified) represented as (S), (C), (R), or (U). It is not necessary to include here abstracts in both official languages unless the text is bilingual.)

(U) This work represents the fourth phase of a project investigating the Canadian Forces (CF) Operational Planning Process (OPP) and an alternative planning process based on intuitive decision making. This is in support of a larger project, Project Minerva, focused on re−examining Command and Control (C2), specifically the CF OPP, in the Land Force in light of the implementation of digitized C2 systems. The CF OPP represents an analytic decision making process in which 1) multiple solutions to the problem must be evaluated and the best selected, and 2) evaluation of solution alternatives must be performed through exhaustive factor−by−factor comparison. Research in the cognitive sciences has suggested that a large portion of human decision making is conducted intuitively; i.e. by less formal, non−analytic processes. Thus, there may be a mismatch between the OPP as laid out in doctrine and taught at training and education institutions within the CF, and the planning process as practiced by command teams in more operational settings, especially at the Brigade level and below.

Specifically, the current work includes the development of an alternative planning process based on intuitive decision making (referred to as the Intuitive Operations Planning Process or IOPP), the development of a training course for the IOPP, and an evaluation of the effectiveness of the IOPP compared to the existing CF OPP.

The IOPP exhibits the best characteristics of other intuitive planning models (Kievenaar, 1997; Schmitt &Klein, 1999; Thunholm, 2005; Whitehurst, 2002) and incorporates findings from previous work investigating application of the OPP in the CF (Bruyn et al., 2005), while maintaining a large amount of the terminology, outputs generated and formal staff briefings used in the OPP in order to promote level of acceptance by CF practitioners and face validity of the IOPP.

A web−based training course for both the OPP and IOPP was developed as it allows more flexibility in terms of the delivery of the training than lecture−based training. Aside from some minor technological complications, delivery of the training courses proved to be successful. Participants provided valuable feedback in terms of training content and delivery that should be taken into account in future training enhancements

The first iteration of the IOPP model resulted in positive feedback from participants in the experimental evaluation. It was also found that the IOPP outperformed the OPP in terms of efficiency, number of steps performed, quality of planning products, usability of planning process, operational effectiveness, and participant workload levels. On the other hand, participants' perceived level of trust and reliability was lower for the IOPP compared to the OPP. They also felt that the IOPP was more likely to lead to errors (and more critical errors) in a Plan. Participants also provided a number of benefits and limitations of the IOPP, which should be considered in future research.

14. KEYWORDS, DESCRIPTORS or IDENTIFIERS (Technically meaningful terms or short phrases that characterize a document and could be helpful in cataloguing the document. They should be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location may also be included. If possible keywords should be selected from a published thesaurus, e.g. Thesaurus of Engineering and Scientific Terms (TEST) and that thesaurus identified. If it is not possible to select indexing terms which are Unclassified, the classification of each should be indicated as with the title.)

(U) Canadian Forces(CF); Operational Planning Process(OPP); Intuitive Operations Planning Process(IOPP); planning process