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An empirical study to evaluate the application of scenario planning methods to military operational planning

Primary topic: Topic 5: Experimentation, Metrics, and Analysis

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Abstract

Despite acknowledged changes in the breadth, complexity and unfamiliarity of operations for which military forces must prepare, the processes by which military planners gain understanding of the operating environment remain more suited to bounded, complicated and familiar situations. Through a current research project, UK researchers have engaged with NATO's HQ ARRC to support ongoing military innovation in this area, and have developed and evaluated a pair of 'understanding' methods, denoted Analysis of Conflict Dynamics (ACD) and Generation of Future Scenarios (GFS), which are based upon key concepts and techniques from scenario planning. This paper reports progress on this topic, including the results of an empirical study investigating the utility of the methods, and discusses their applicability within the military (operational and higher-tactical) planning domain.

Introduction

As a core activity within the UK MOD Command, Inform and Battlespace Management (CIBM) Research Package in the 2012-2014 timeframe, Dstl tasked an industry-academia consortium (Team Solomon[1]) to investigate potential improvements in ways of producing and communicating plans, intent and courses of action: CIBM Research Task 8, Planning and Decision Support. The vision for Task 8 was that it should develop and test potential interventions through a campaign of experimentation, and exploit these intervention ideas through the participation of stakeholders.

As part of this campaign, an empirical study was conducted in December 2012 with the NATO Allied Rapid Reaction Corps (ARRC) Headquarters. HQ ARRC's existing planning processes are consistent with the NATO Comprehensive Operational Planning Directive (COPD) [1]; the study aimed to investigate the utility and applicability of alternative methods to support the development of understanding about the operating environment, which are relevant to Phases 1-3 of the COPD operational-level planning process.

These methods were *Analysis of Conflict Dynamics* (ACD), and *Generation of Future Scenarios* (GFS). Both methods were developed by Team Solomon based upon previous concept development and experimentation with the Swedish Armed Forces, supported by QinetiQ [2]. GFS is based upon the most popular and 'standard' variant of *scenario planning,* developed by Royal Dutch/Shell in the 1960s [3] [4]. GFS enables the generation of a set of scenarios that convey plausible, yet very different, futures within the operating environment. Their purpose is to describe a *space* of possible futures that might occur – which is naturally of meaning and interest to planners. The key difference between GFS and 'standard' scenario planning is that the former is tailored for use within military planning and thereby includes an exploitation stage that supports Mission Analysis and Design. Further, ACD supports preparation for GFS through a staged analysis of the current situation and its drivers, thus providing the basis for postulating what might drive the future.

This paper is presented in two parts. Part 1 outlines a number of perceived issues with the 'understand' element of operational planning processes and proposes the ACD and GFS methods for addressing these issues. Part 2 describes the empirical study conducted with HQ ARRC staff, summarizes its findings and discusses the applicability of scenario planning methods within the military operational and higher-tactical planning domain.

[1] The consortium lead is QinetiQ and the other organizations involved in this research task were Cranfield University and BAE Systems.

PART 1: TOWARDS A SCENARIO PLANNING BASED APPROACH TO DEVELOPING UNDERSTANDING OF THE OPERATING ENVIRONMENT

The 'understand' element of military operational planning

Military operational planning processes invariably include an early 'understand' element, the purpose of which is to enable commanders and staff to develop understanding of the operating environment, thus providing them with a solid foundation for conceptualizing operations and developing courses of action.

According to NATO COPD, 'understand' activities at the operational level are conducted in parallel with similar activities at the strategic and tactical levels. They begin as early as Phase 1 (Situational Awareness), prior to the receipt of any strategic direction. These activities continue during Phase 2 (Operational Appreciation and Assessment of Options), where it is framed by Strategic Situation Assessment and Military Response Options. It culminates in Phase 3 (Operational Orientation) and leads directly into Mission Analysis. Hence the operational 'understand' element is, to some extent, given direction and scope before operational planners begin the deliberate activity of orienting themselves to the environment they are likely to face. These operational 'understand' activities are summarized in Table 1, below.

COPD Phase	'Understand' activities within Phase	Lead Branch
Phase 1	Developing a systems perspective on the area of interest, including an appreciation of: • The main actors; • The background to the situation; • The dynamics of the current situation; • Operational threats and risks.	G2
Phase 2	Initiating a Comprehensive Preparation of the Operating Environment (CPOE), which builds upon the systems perspective and addresses: • The nature, scale and scope of the crisis; • The strategic context for the crisis; • Each actor's role in the crisis, including their goals, objectives motivations, culture, values, beliefs and prevailing attitudes	G2
Phase 3	Developing the CPOE, including analysis of: • Instruments of power available to each actor; • System interactions: strengths and weaknesses of main actors in terms of capacity to influence other actors and systems – and critical system relationships; • Military capabilities of each actor; • Possible adversarial actions. Generating factors for use, within Mission Analysis (also Phase 3), in the 3-column format: Factors-Deductions-Conclusions.	G5

Table 1: Summary of operational 'understand' activities, based on NATO COPD [1]

Essentially, these activities encourage a broad, systemic analysis of the operational environment (Phase 1) that is framed and deepened, with a focus on underlying causes (Phase 2) and then given an 'action focus' through the identification of points of influence (Phase 3).

Issues with developing understanding of complex situations

The authors perceive a number of issues[2] with the 'understand' element of developing understanding of complex situations, which may have a negative impact on the quality of understanding developed.

- **Strategic bounding of the situation**. Given the parallelism of 'understand' activities at different NATO levels of command, Strategic Assessments and corresponding Military Response Options provide focus for operational 'understand' activities. From an operational perspective, this also tends to bound the crisis situation. Whenever such crisis situations bear the hallmarks of 'wicked problems' [5], however, there is no guarantee that strategic judgement about the nature of the situation (and consequently response options) is appropriate, because the very nature of wicked problems reveal themselves as they are analyzed and engaged with. Thus there is a possibility that strategic bounding of the situation, if adhered to rigidly at the operational level, may inhibit understanding of the operating environment.

- **Staffing**. There are two issues here. Firstly, 'understand' activities tend to be led, initially, by G2 (Phases 1 and 2) before being handed over to G5 (Phase 3). Whilst there is often some continuity of staffing across the phases, the handover is handled primarily through briefings and products, which may fail to impart understanding, particularly when the situation is complex. Secondly, complex situations – particularly those demanding a CJIIM response – require a diverse mix of expertise during 'understand' activities because they invariably present a greater breadth of issues than any single organization can make sense of. When such activities are staffed by the military alone, the understanding may be biased in favour of military issues.

- **Time pressure**. Whilst Phases 1 and 2 may be conducted over longer time periods, Phase 3 (Operational Orientation) tends to take place in a relatively compressed timescale, typically engaging planning staff for often less than a week[3]. It is recognized that time pressure is an enduring issue for military planning at all levels. Developing *mature* understanding of complex crisis situations takes time, however, because it invariably requires both access to external expertise and deep consideration of underlying causes.

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[2] Although such issues are expressed in the terminology of NATO's operational planning process, they are not unique to NATO operational planning. Indeed, such issues are based on observations of military exercises and experiments, made by the authors over a period of 10 years, as well as theoretical considerations of the methods currently employed.

[3] This is typical for HQ ARRC and UK Joint Force Headquarters exercises. Whilst supporting analysis is typically conducted over a longer period, this is invariably conducted by Intelligence staff.

- **Lack of conceptual or methodological guidance**. Whilst PMESII and ASCOPE[4] provide two complementary dimensions for categorizing perceived environmental phenomena, there is little guidance on how the dynamics of the operating environment should be conceptualized (or modelled) and how to achieve this.
- **Focusing upon production of output**. Arguably, the lack of conceptual or methodological guidance, coupled with time pressure, tends to direct planners towards the generation of a planning 'output' (such as a diagram, model, or section of text) at the expense of deepening their understanding about the operating environment.
- **Focusing on symptoms rather than underlying causes**. In practice, existing 'understanding' techniques tend to focus upon symptoms of crises rather than underlying causes – perhaps due to a lack of conceptual or methodological guidance, a focus upon the production of outputs and time-pressure. This renders understanding as the appreciation of those 'factors' that comprise the current situation.
- **Premature orientation towards action**. Operational 'understand' activities culminate in Operational Orientation, which necessarily provides focus and direction for Mission Analysis. Orientation may become problematic, however, if it is not supported by mature understanding of the operating environment. For example, the standard use of the 3-column format tool within Operational Orientation focuses attention on situational factors, deductions from those factors and conclusions for operational action; it encourages commanders and staff to 'fit' operational responses to distinct aspects of the current situation, based upon operational experience – but if the understanding about the operating environment is immature, then there is a risk that key factors will be missed. Further, if Orientation is shaped by a strong notion of desired outcomes (or even a pre-specified operational End State), this may lead to a simplification of situation appreciation in line with such outcomes.
- **Reductionist thinking**. Focusing on symptoms and 'action orientation' may lead to a piecemeal approach to Operational Orientation, whereby deductions and conclusions are drawn about individual factors. This is reinforced by the 3-column format and enabled by reductionist thinking, which encourages the situation to be treated like a problem that can be reduced to its component parts. The result is that any *holistic* appreciation of the operating environment is impeded, which is a critical issue when dealing with complex situations.
- **Forecasting**. Existing techniques tend to collapse appreciation of future outcomes onto one or two forecasts (e.g. 'most likely enemy course of action' and 'most dangerous enemy course of action'). There is a danger that such forecasts provide only a limited snapshot of what might plausibly occur

[4] Area, Structures, Capabilities, Organizations, People and Events [6].

because they focus on specific adversarial actors (and therefore describe destabilizing rather than stabilizing effects in the operating environment). Further, if they are developed without a well-developed concept of the operating environment and are based on symptoms of the crisis rather than underlying causes, they may omit important dynamics and simply extrapolate observable trends in the current situation. All such factors create the risk that appreciation of plausible future situations is oversimplified, reinforcing poor understanding of the operating environment.

Requirements for the 'understand' element of operational planning

The issues highlighted above raise some key requirements for the 'understand' element of operational planning:

1. A forum for a diverse set of experts (military planners, military intelligencers, civilian planners and other specialists, as required) to develop shared understanding about a crisis situation;
2. A way of developing a shared concept for the dynamics of the operating environment, expressed at the level of underlying causes for the crisis;
3. Structured thinking about future outcomes for the crisis that is both holistic and does not collapse uncertainties onto singular forecasts.
4. A way of exploiting all such shared understanding about the crisis to support operational planning.

Analysis of Conflict Dynamics and Generation of Future Scenarios

Two methods were proposed to satisfy these requirements: Analysis of Conflict Dynamics (ACD) and Generation of Future Scenarios (GFS). Both methods were developed by Team Solomon based upon previous concept development and experimentation with the Swedish Armed Forces, supported by QinetiQ. ACD and GFS are based on the most popular and 'standard' variant of scenario planning, which is a methodology for thinking about the future to support strategy and planning, widely used within the public and private sector[5]. Additionally, ACD is based on the same foundations as a number of 'conflict analysis' methods developed by civilian agencies [8] [9].

ACD and GFS form part of an end-to-end process for Operational Orientation, which is designed to be led by G5 but supported by G2 (and other branches, as required) – and requires the participation of civilian planners. ACD and GFS are therefore 'generalist' rather than 'specialist' methods. Although the methods require leadership

[5] Scenario planning can be traced back to the work of Herman Kahn who, whilst based at RAND and working with the US military in the 1950s, developed the concept of a scenario as a story written about the future. As Kahn moved into the civilian domain, scenario-based thinking was adopted and developed into the classic methodology by Pierre Wack, at Royal Dutch/Shell in the mid 1960s, as a tool to support strategic planning [3].

and facilitation, there is no specific requirement for the role of command[6]. The process is designed to completed in 4-5 days.

The purpose of the ACD/GFS process is to enable a diverse set of experts to develop shared understanding about the breadth of plausible futures outcomes for a crisis situation, and thereby identify risks and opportunities that they face in responding to that situation, which may support the generation of candidate planning concepts. This is based upon generating shared content, which culminates in a set of scenarios for the future that map out the space of possibilities.

The initial stages of ACD are similar in scope to CPOE because they provide an analytical approach to developing understanding about the current situation and its causes. ACD is distinct from CPOE, however, in that provides the basis for constructing models of the operating environment rather than simply asking analytical questions. GFS represents a departure from existing methods because it is focused on constructing views about the *future* operating environment. Because consideration of the future is fundamentally uncertain and subjective, GFS enables participants to elicit their shared assumptions about future outcomes and thereby serves as a vehicle for ongoing learning about the dynamics of the operating environment.

The ACD/GFS process comprises six stages and incorporates a number of concepts from scenario planning: Driving Forces, Key Question and Scenarios. The process is outlined in Table 2, below, and this is followed by a discussion of the process that includes definitions of the concepts.

Stage	**Key Elements**
ACD1 *Analyze current situation*	• Use a framework such as PMESII to focus, in breadth, on current situation • Analyse destabilizing and stabilizing relationships within the current situation and identify the actors and/or systems involved. • Synthesize all perceived relationships to generate a shared map of the current situation (e.g. a rich picture and/or a social network)
ACD2 *Analyze Past Driving Forces*	• Analyse actors' interests, motives, sources of power, and dynamics underlying the current situation • Use such analyses as basis for creative thinking about candidate Past Driving Forces • Brainstorm and synthesize set of Past Driving Forces and postulate causal relationships between them to generate a shared map of the causes for the current situation.
ACD3 *Develop Future Driving Forces*	• Set Key Question (time horizon, scale, issues etc.) to guide consideration of future situations. • Postulate actors' future interests and sources of power, plausible dynamics of action, plausible future events and trends • Use such content as basis for creative thinking about Future Driving Forces

[6] Whilst this does not preclude the involvement of the commander (indeed, this is encouraged so that the commander may deepen his own understanding of the operational problem) it is important that the choices made within the process are not command decisions.

Stage	Key Elements
	• Brainstorm and synthesise set of Future Driving Forces and postulate relationships between them to generate a conceptual model of the (drivers for the) future operating environment
GFS1 *Outline scenarios*	• Characterise Future Driving Forces with respect to 'importance' and 'uncertainty' • Select two Key Future Driving Forces that have high importance and high uncertainty, build matrix of 2 x 2 scenarios based upon all 4 combinations of the extreme plausible outcomes (poles) of both Key Future Driving Forces. • For each scenario, reason about outcomes of other Future Driving Forces and thereby add them to the scenarios (appealing to the logic of the shared map from ACD3)
GFS2 *Develop scenarios*	• Develop concrete story elements for each scenario (reusing earlier ACD thinking and outputs) • Write storylines covering period from now to time horizon (set by Key Question)
GFS3 *Exploit scenarios*	• Share scenarios, hold dialogue about challenges, risks and opportunities, and uncertainties – to deepen understanding about breadth of plausible futures. • Generate a set of conditions that may potentially unfold, and associated indicators, based on this deep understanding

Table 2; outline of the ACD/GFS process

During ACD1, the G5-led team generates its own analysis of the current situation, building upon the expertise and knowledge of other team members and any existing 'specialist' analyses[7]. This is done in a comprehensive manner[8] and aims to generate a shared view on the key destabilizing and stabilizing relationships that define the current situation, and which actors and/or systems[9] are involved in such relationships. The focus on relationships, rather than simply elements (actors and systems), enables a holistic appreciation of the current situation, which is critical for consideration of underlying causes in ACD2.

ACD2 deepens the analysis through an examination of actors' interests, motives and sources of power and provides a platform for brainstorming and dialogue about underlying causes for the current situation. An underlying cause is represented by the concept of a Driving Force (DF), which is drawn from the scenario planning literature [3] [4]. ACD2 thereby supports the generation of *Past Driving Forces*.

ACD3 concerns the future and requires a greater degree of creative thinking than ACD2. The focus for ACD3 is provided by a Key Question, which sets the bounds for consideration of future outcomes. It includes a timeframe of interest, a region of

[7] In the current approach to developing understanding, CPOE begins as a G2-led activity before being completed as a G5-led activity. Hence there is a notion of 'specialist' G2 analyses being exploited by 'generalist' G5 thinking. ACD is posited as a method for 'generalists', hence also must ensure that existing 'specialist' analyses are exploited. The best way to achieve this is the integration of G2 staff, and other specialists, within the team.

[8] For example, across PMESII dimensions.

[9] For example, political systems, economic systems, belief systems, cultural norms etc.

interest and a notion of the types of issues to be explored. The team then structures its consideration of the future operating environment by postulating those actors that they believe will play a key role and their plausible interests, motives and approaches; plausible sources of future stability and instability; and plausible trends and events. This provides a platform for brainstorming and dialogue about *Future Driving Forces*. Here, the Driving Force concept is expanded to represent the range of uncertainty that the team has about plausible future outcomes of the underlying cause in question. Any Future DF is thereby characterized as a variable that may have a range of outcomes; it comprises a variable name and two 'poles', which describe its extreme *plausible* outcomes. Future DFs are essentially the building blocks of a conceptual model about the dynamics of the future operating environment. This is generated by mapping hypothesized causal links between such DFs.

Figure 1 illustrates both how Future DFs may be described and mapped to form such a model. Each of the four Future DFs in the example model is represented by a circle with a variable name in the centre and the two poles at the top and bottom. Causal links are described qualitatively. The positive (+) relationship between Security Situation and Government represents a hypothesis that if the security situation becomes more stable, then the government is more likely to be accepted and perceived as legitimate and effective – and that if the security situation becomes less stable then the government is less likely to be accepted and perceived as legitimate and effective'[10]

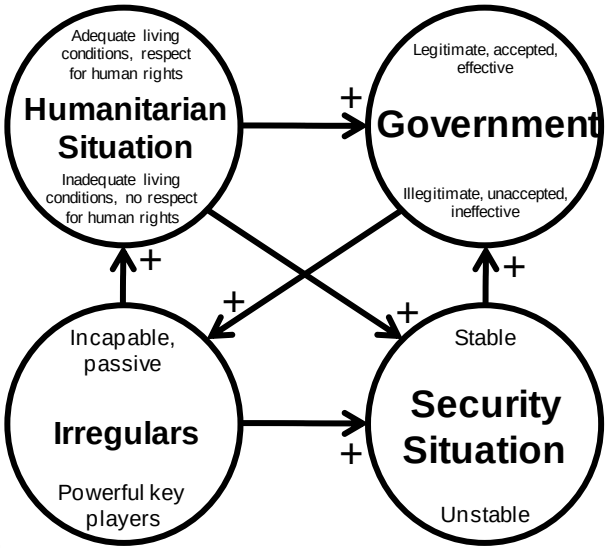

Figure 1; Example conceptual model, based on Future Driving Forces

GFS1 begins the process of generating scenarios. A standard scenario planning technique is to select two Future DFs that are relatively important, relatively uncertain and relatively independent from each other. These *Key* Future DFs are then used to describe a set of four distinct scenarios. Each scenario is essentially fixed to a

[10] Although negative relationships are not shown in Figure 1, their logic is essentially reversed.

unique combination of the poles of the two Key Future DFs. The rationale for this technique is that it generates scenarios that are:

- Plausible – because they are based on a combination of plausible outcomes
- Different – because the Key Future DFs have a relatively large range of uncertainty associated with them, and because they are relatively independent.
- Meaningful – because the Key Future DFs are perceived as having relatively high importance (amongst all other Future DFs) in shaping the future operating environment.

There is no guarantee, however, that the technique above will produce satisfactory scenarios; working through the technique may change the team's assessment of the importance, uncertainty and independence of the Key Future DFs. Hence once four scenarios have been identified and named, the team must make judgments about their plausibility, difference and meaning – and iterate the technique with a different pair of Key Future DFs, if required. Once the selection has been agreed, the team then reasons about the outcomes of all other Future DFs within each scenario, appealing to the logic of the conceptual model as a guide.

GFS2 serves to bring the scenarios to life by developing each into a story about how the current situation might evolve into a specific future situation. Because each scenario represents a choice about how each of the Future DFs in the model might turn out, it is underpinned by a notion of *change* in the outcomes of DFs – from an assessment of their 'status' in the current situation to a postulated set of outcomes at the time horizon set by the Key Question. The scenario storyline then serves as a plausible account of how these changes might manifest themselves. Stories are full of concrete details, such as events, actors and changes in relationships. Identifying and developing such details requires a large degree of creativity, yet the analyses generated during ACD provide a starting point. Details bring the scenarios to life and also help the team to discover some of their assumptions about the dynamics of the future operating environment.

GFS3 concerns the exploitation of the scenarios – and, more importantly, the shared understanding that has been developed during the process. The scenarios are a vehicle for identifying the breadth of challenges, risks and opportunities in the future operating environment; no single scenario should be considered as a forecast. It is important that the team shares the scenarios and holds dialogue about their meaning – because, invariably, the storylines include surprises and provoke thought. A final step serves to support ongoing planning by using the content of the scenarios as a catalyst – to generate candidate planning concepts, for example:

- A set of *conditions* that may plausibly unfold in the future.
- A set of *indicators* for these conditions.

By making value judgments about such conditions (i.e. whether they are desirable or not in the context of the mission), planners may then take them forward into Design. This necessarily requires this final step within GFS3 to be conducted during Mission Analysis.

Although ACD/GFS is introduced above as a process, it also requires a particular form of mindset. This *mindset for scenario planning* is described in Annex A.

Hypothesized benefits of ACD and GFS for operational orientation

A key driver for the development of ACD and GFS was to address the issues associated with the 'understand' element of operational planning described above. The following table summarizes the hypothesized benefits of ACD and GFS for operational orientation in terms of how they might ameliorate such issues.

Issue	**Hypothesized benefit of ACD & GFS – and how it ameliorates this issue**
Strategic bounding of the situation	Whilst ACD & GFS cannot address this issue directly, they do encourage a broad view of the operating environment.
Staffing	ACD & GFS encourage a diverse team of experts, including G5, G2 and civilian planners, to engage in shared analysis and structured imagination about the future. Provided this diversity is maintained throughout the process, both aspects of the staffing issue may be ameliorated.
Time pressure	Whilst ACD & GFS cannot address this issue directly, they do encourage debate about the value of apportioning a sufficient amount of time to the conduct of orientation.
Lack of conceptual or methodological guidance	ACD & GFS are designed, directly, to address this issue. This is achieved through the development of a conceptual model for the (drivers of the) future operating environment and a structured method for consideration of future outcomes that harnesses, rather than marginalizes, uncertainty and complexity.
Focusing upon production of output	ACD & GFS emphasise ongoing engagement in a process as a means of supporting understanding, rather than the generation of products.
Focusing on symptoms rather than underlying causes	ACD is tailored towards a deepening of analyses from concrete elements of the current situation (symptoms) to driving forces (underlying causes). By treating both symptoms and underlying causes explicitly it avoids potential confusion between the two – and thereby ameliorates the issue on the left.
Premature orientation towards action	ACD & GFS serve to ameliorate this issue by encouraging a stronger focus on sensemaking and the development of understanding about driving forces for, and the breadth of possibilities for, future situations – prior to any specific consideration of action.
Reductionist thinking	The holistic approach within ACD & GFS (e.g. focusing on relationships in the current situation, considering causal relationships between a comprehensive set of drivers) inhibits reductionist thinking.
Forecasting	GFS ameliorates this issue by establishing and developing a set of distinct yet plausible scenarios, based on a comprehensive of drivers, that describes a *space* of possibilities. It also encourages subsequent operational planning activities to consider the breadth of risks and opportunities that exist across all such scenarios.

Table 3: Hypothesized benefits of ACD & GFS for Operational Orientation

PART 2: ACD/GFS EMPIRICAL STUDY WITH HQ ARRC

In December 2012, Team Solomon was invited to teach and facilitate the ACD/GFS process at a HQ ARRC workshop. This enabled the research team to conduct an empirical study to assess the benefits, scope of application, and potential implementation of ACD and GFS, specifically within Operational Orientation.

Research Questions

The research questions for the empirical study were:

1. Will participants develop more complex mental models of the situation through the practice of ACD and GFS?
2. Will participants be more able to voice uncertainty about the situation, it's dynamics and possible futures through the practice of ACD and GFS?
3. Will participants maintain, collectively, a broader range of alternative plausible storylines about the future operating environment through the practice of ACD and GFS?
4. Will participants be more aware of a broader range of possible outcomes of the current situation through the practice of ACD and GFS?
5. Will participants be able to compare the benefits and limitations of both ACD/GFS and existing methods for developing understanding in support of operational planning?

Study design

The workshop took place at HQ ARRC over the course of two days. Seven NATO staff officers participated in the workshop, with ranks ranging from Colonel to Major. ACOS G5 took on the role of team leader. The workshop was divided into six parts, one for each of the stages of the ACD/GFS process. For each part, the research team first taught the corresponding ACD/GFS stage and then facilitated the participants in following the relevant methods. Due to the time constraint of the workshop, each stage was compressed[11].

The workshop focused on a specific real-world crisis situation. Participants varied considerably in the amount of time they had spent investigating and discussing the situation prior to the workshop (from a few hours to approximately 100 hours). A wash-up discussion was held at the end of the workshop, during which participants were invited to feed back their thoughts on the implementation of the ACD and GFS methods.

Data was collected from three main sources:

- Contemporaneous notes made by observers;
- Questionnaires completed by participants (see Annex B); and

[11] The workshop was 2 days and the ideal duration for ACD/GFS is 4-5 days.

- The content of the written and diagrammatic material developed by the participants in the course of the workshop.

The study findings, below, are organized under three headings. The *account of the workshop* summarizes the activities of the team during each stage of the ACD/GFS process, with reference to the specific research questions. The *themes in observations* provide further insight into the applicability of the methods and the *themes in participant feedback* summarize the questionnaire responses and the content of the wash-up.

Study findings – account of the workshop

The military participants followed every stage of the ACD/GFS process, according to the guidance provided by the research team, except for Scenario Exploitation (GFS3), which was largely omitted due to additional, and unforeseeable, time constraints at the end of the second day. An account of the workshop is provided below, organized by ACD/GFS process stage.

Analyze Current Situation (ACD1)

The team began exploring the current situation using a standard method: they elicited their own perceived factors, across all PMESII dimensions, and documented them in the standard 3-column format (factors-deductions-conclusions). Then the participants began to apply ACD1: individual team members addressed the ACD1 questions before participating in a group brainstorming session to develop a shared visual map of key actors and their relationships.

The shared map was arguably richer than the original PMESII analysis captured in the 3-column format because it highlighted sources of stability and instability in the current situation, and drew out relationships between actors in an explicit manner. The method also uncovered several aspects of the situation where understanding was weak – and this served to make uncertainties explicit. Although not a primary purpose of ACD1, the dialogue enabled multiple plausible accounts of how the current situation might have come to exist; participants started to identify possible symptoms and plausible causes.

Team members commented that they appreciated the need to avoid consideration of any possible End State in framing the current situation. They also stated that ACD1 increased shared understanding and that it was more dynamic and more inclusive than existing methods.

Analyze Past Driving Forces (ACD2)

Participants addressed the ACD2 questions individually and generated candidate Past DFs on post-it notes. Next, they took part in a group brainstorming session to generate a shared set of Past DFs. Relationships between these DFs were visualized and explored through dialogue.

The dialogue about Past DFs was rich and diverse and perhaps would have been even richer without the experiment time constraint. Participants expressed

uncertainty about the situation by discussing DFs as plausible, rather than definitive, causes; relationships between DFs were also explored through dialogue, which included arguments and counter-arguments. As in ACD1, alternative accounts of the causes of the current situation were discussed. This occurred as candidate Past DFs were brainstormed. Importantly, the team did not feel the need to select 'most likely' narratives – all were maintained.

The participants felt that ACD2 developed shared understanding and resulted in a deeper analysis of the situation than existing methods because it focused on why the current situation might exist, rather than simply its characteristics. It was also recognized that this activity demands more diverse participation than existing methods, e.g. participation from G2 would be beneficial.

Develop Future Driving Forces (ACD3)

ACOS G5 set the Key Question to scope the team's consideration of plausible future outcomes, which included a timeframe and all relevant friendly, neutral and adversarial actors. Next, individual team members addressed the ACD3 questions and, consequently, generated candidate Future DFs. This was followed by a group brainstorming session to generate and a shared set of Future DFs. The team then postulated a set of causal relationships between the DFs to generate a shared causal map.

The physical mapping of DFs onto paper or a whiteboard enabled the participants to explore their uncertainty about the situation and the representation of causal links between DFs aided their understanding, on an individual and group level.

The set of Future DFs included some that had no basis in Past DFs. This led to a 'lightbulb moment' for the participants – they realized that the method opened up new lines of enquiry into crisis situations that would not be followed using existing methods. The content of the dialogue included plausible events and multiple fragments of storylines; as in ACD2, these expressions were inherently uncertain rather than definitive in nature. Participants acknowledged that consideration of Future DFs was wholly novel and useful. Whilst a rich set of Future DFs was developed, this would have, perhaps, been even richer without the workshop time constraint.

Outline Scenarios (GFS1)

The team assessed each DF for its relative importance (with respect to influence on future outcomes) and relative uncertainty (with respect the range of plausible outcomes between the poles). Whilst this assessment is subjective, the team had no issues in making the required judgements. ACOS G5 then used this assessment to select two Key DFs, which we among the most important and most uncertain.

As above, this stage was wholly novel to the team. Assessing Future DFs for importance and uncertainty, which serves the methodological purpose of aiding the choice of Key DFs, also led to further dialogue within the group, suggesting that this activity helped participants to develop their mental models of the situation. Participants highlighted that they found it very useful to consider the future with DFs

corresponding to friendly actors because this enabled them to explore their own role in addressing future crises (in terms of degree of involvement).

Develop Scenarios (GFS2)

The team visualized the two Key Driving Forces as two axes of a space of scenarios and examined the possible combinations of the poles (extreme outcomes) of each, thereby describing four plausible scenarios. Each scenario was then developed by the team through dialogue about plausible outcomes of all other DFs; this included naming the scenarios. ACOS G5 then assembled four sub-teams, each of which developed a storyline for a specific scenario, thereby introducing concrete details (such as actors, events, relationships etc.)

By design, this stage supports open-minded thinking about the future environment because it establishes multiple scenarios that describe different future outcomes. Before the sub-teams were assembled, the participants were already starting to identify and ascribe meaning to the range of outcomes represented by the four scenarios they had outlined.

Exploit Scenarios (GFS3)

The sub-teams briefed the four scenarios to the whole group. This was followed by a period of dialogue about the scenarios. The team recognized that the scenarios included a range of outcomes, both desired and undesired) together with implicit conditions (that is, turning points in the storylines) that make such outcomes possible. This stage was not completed, however, due to time constraints – hence there was no formal exploitation of the understanding that the team had gained from scenario development.

During GFS3, the benefit of GFS1 and GFS2 became apparent to the participants. One participant commented that GFS3 felt like “exploring many End States but in less detail” and many participants said that this activity may have benefits over focusing on a single ‘optimal’ End State.

Study findings – themes in observations

A thematic analysis was applied to the observer notes, providing further insight into the utility of ACD and GFS. A summary of the themes are outlined in Table 4, below.

Theme	Outline	Implications
'End-state thinking'	Whilst participants stated that their usual practice is to frame orientation around a shared, explicit End State, by the end of the workshop they understood the utility of developing understanding without explicit reference to an End State. (Instead, the Key Question framed their thinking).	The study appears to support the argument that an End State is not necessary in directing the development of relevant understanding.
Output orientation	At each stage of the technique, participants were keen to generate tangible products.	Output orientation may inhibit a dynamic appreciation of the situation and limit the depth of understanding achieved.
Current techniques for complex problems	Participants acknowledged that their current use of baseline planning techniques (e.g. 3-column format) is not comprehensive and does not necessarily facilitate dynamic understanding of a complex problem. They also stated that they were dependent upon G2 to generate situational understanding.	There is also a perceived need to go beyond PMESII and the three-column format, to achieve a more dynamic understanding of the given situation and its underlying dynamics. A dependency on G2 to generate situational understanding of the wider HQ may limit the potential of the effectiveness of current processes.
Time-pressure	The issue of time-pressure was raised consistently, by the participants, throughout the workshop. It may have acted as a catalyst for 'output orientation'.	Developing understanding of complex situation requires time and there is a danger that they will become too product-focused (rather than focused on the development of understanding) if time is tight.
Exploitation of understanding	Participants were acutely aware of the context within which they were acting and were keen to identify where they felt the greatest utility for the proposed method would be.	Increased understanding of a problem situation, its context and plausible futures, could act to increase the ability to influence.

Table 4; Themes extracted from observations of participants

Study findings – themes in participant feedback

Participant evaluation of the methods, elicited from both questionnaire responses and the wash-up, provided additional insights into the applicability of ACD and GFS to Operational Orientation. A summary of the themes identified are included in Table 5, below.

Theme	Outline	Implications
Broader and deeper understanding of the crisis situation	Participants reported increased breadth and extent of understanding about the crisis situation, both individually and shared, through understanding the Future Driving Forces, and how they might shape future situations. Participants generally felt that every stage of the methods facilitated the generation of more complex mental models for the situation. One participant stated that the understanding gained was more 'dynamic' because it was not based on the 3-column format Some participants reported that the methods had little impact upon the way they felt they understood the situation.	Even when practiced in a compressed timescale, ACD & GFS meet the primary aim of supporting broader and deeper understanding of complex situations.
Value of the process	ACD/GFS is... "very good for taking your thought process on a different journey"	This was an isolated comment, yet the authors believe that it is a key benefit of ACD & GFS that would be more widely recognized with practice.
Implementation of the methods	Some participants stated that ACD1 was similar to current methods. Participants agreed that the methods would be of most benefit in the 'understand' element of planning. "in doing four quadrants [scenarios] you very quickly work out what your acceptable conditions are" Participants suggested that scenarios might provide basis for 'scoring' COAs, thus supporting risk management "ACD/GFS enables thinking about where the situation may go... 'what if', not 'where we think it may go for us'."	There is broad agreement that the ACD/GFS process should support Operational Orientation, although the differences between ACD1 and CPOE (i.e. the holistic, relationship-based approach) must be described with greater clarity Despite GFS3 not completing, the natural exploitation of the scenarios within Mission Analysis was recognized. The use of the scenarios within COA Development/Wargaming should be investigated further.
Time	There were reservations about the applicability of methods in high-tempo planning.	Two days is too little time to conduct the end-to-end process fully, which rules it out (in its current form) for high-tempo planning
Staffing	Participants suggested that methods should be staffed by multiple branches (including G5, G35 and G2) and that civilian organizations would benefit from involvement	Noting that the workshop was staffed only by G5 and G35, it was encouraging that need for diverse expertise was recognized

Table 5; Themes extracted from participant feedback

Conclusions

With respect to the specific research questions, the study findings indicate that practicing the ACD and GFS methods enables participants to:

1. Develop more complex mental models of the situation – including models about what might drive future outcomes;
2. Voice – and represent, in the concept of a Driving Force – more uncertainty about the situation, its dynamics and possible futures. (Arguably, this is also enabled by the dialogue-based approach and the diversity within the team.)
3. Maintain, collectively, a broader range of alternative plausible storylines about the future operating environment. Whilst this is exactly what ACD and GFS are designed to enable, the participants did not express the desire to collapse the range of storylines onto 'most likely' and 'most dangerous' cases.
4. Become more aware of a broader range of possible outcomes of the current situation. There was evidence for this in the observations of GFS3 ("exploring many End States but in less detail"), despite this stage being brought to a premature conclusion.
5. Compare the benefits and limitations of both ACD/GFS and existing methods for developing understanding in support of operational planning. There was certainly evidence for this throughout the workshop. The key added benefit of ACD/GFS is in supporting broader and deeper understanding of complex situations.

Discussion

Scenario planning in general, and ACD/GFS specifically, raise a number of additional questions for the conduct of Operational Orientation.

Firstly, it is noted that the traditional application of scenario planning, the environment and the organization conducting planning are seen as separable entities. Future Driving Forces tend not to describe the possible policies or actions of the organization within that environment. Yet military forces are, by their very nature, both interventionist and disruptive to the environment. A consequence of this is that is difficult to imagine a set of driving forces for the future of a crisis situation without including driving forces that account for uncertainties about the type and scale of military response, and even some driving forces that account for uncertainties about command intent. Whilst it is possible to develop such driving forces (and, indeed, this is encouraged by GFS), further consideration needs to be given as to how such driving forces are handled within scenario generation, particularly because the commander will likely engage with the scenarios at some point.

Secondly, and associated with the first point, is the issue of how and when to engage the commander in ACD and GFS. Outside the military domain, it is highly recommended that scenario planning be conducted as a strategic activity, with the CEO championing the process and engaging fully in it. By the same argument, the

commander should be fully engaged in (at least) GFS so that he fully appreciates the breadth of possibilities for the future of the crisis situation that he is facing. There are other issues, however, in introducing the concept of 'rank' to GFS. It is a highly creative process, within which there are no 'correct' or 'incorrect' answers – yet many judgments and commitments must be made (so that four scenarios can be developed from the much broader space of possibilities) – and for open dialogue is a fundamental requirement. The presence of the commander within the set of participants may inhibit such creativity and openness; it may also lead to all judgments and commitments being deferred to the commander himself, even though they do not represent command decisions. One potential way around this relies upon the strength of personality of the commander himself – in establishing a culture of openness, creativity, exploration and learning during operational orientation. He may then engage fully in GFS. Another possibility was identified by the experiment participants: the commander could join the process at a late stage and develop his own understanding based upon engagement with both the scenarios and their authors.

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Annex A: A 'mindset' for scenario planning

Scenario planning is not a *planning* methodology, as such, but a methodology for making sense of complex, dynamic situations. It therefore requires a particular mindset, described as follows:

- Although Driving Forces are developed on the basis of both evidence and expert opinion, they are socially constructed and therefore subjective. The inherent uncertainty about Driving Forces and their interrelationships requires them to be treated as a set of shared hypotheses about the dynamics of the environment; they are therefore subject to learning as further evidence is surfaced, expert opinion is accessed and, importantly, as the environment is engaged with.
- The quality of understanding developed through scenario planning is enhanced through the collaboration of a diverse set of stakeholders; this diversity should, ideally, be greater than the breadth and complexity of the situation under consideration[12].
- Scenario planning is aided by systems thinking. This applies both in general – in the holistic appreciation of the situation – and, specifically, in the construction of Driving Forces and their interrelationships[13].
- Scenario generation is necessarily a creative, rather than an analytical, process. To manage the 'combinatorial explosion' of possibilities for the future, this creativity is directed towards the critical selection of outcomes of driving forces for each scenario and associated story elements (the 'concrete details' described above). There is no 'correct' way of doing this (see also the next point); instead, such selections are valued based on their plausibility, resonance and consistency with the 'logic' of the Driving Forces.
- It is critical that planners understand what the set of scenarios *represents*. The purpose of the set is to help planners understand the breadth of issues (challenges, risks and opportunities) that they need to consider in developing plans. It thereby encapsulates their inherent uncertainty about the future, as well as the complexity of the environment[14] – and enables planners to explore the valencies and potentials for plausible future situations. A corollary of all of the above points is that specific scenarios should not be treated as predictions; scenario planning should be used to develop understanding, challenge basic assumptions and learn about the environment, rather than as a 'what if' tool.

[12] This is essentially Ashby's Law of Requisite Variety

[13] This is aided by causal loop diagramming [7]

[14] It should be noted that the space of plausible outcomes for the future is constrained both by what scenario planners can imagine, and by what is knowable about the environment.

Annex B: Questionnaire

1. Do you feel that your understanding of the situation changed as a result of taking part in this workshop? If so, in what way?
2. Before the workshop began, roughly how much time (in hours) had you spent investigating this situation (reading, discussing, and planning)?
3. Have you learned anything new about the other participants' understanding of the situation? If so, can you give an example of what you learned, and at what stage of the process this happened?
4. Are there important aspects of the situation that were not discussed during the workshop? If so, please give some examples.
5. Thinking back to the earlier, ***driving forces*** phase of the workshop: did the specific activities that made up this phase have any impact on the way that you understood the situation? If so, in what way?
6. Is there anything that you would consider changing, about the way the *driving forces* phase was conducted (e.g. techniques used, templates for products)?
7. Looking now at the ***scenario development*** phase of the workshop: did the specific activities that made up this phase have any impact on the way that you understood the situation? If so, in what way?
8. Is there anything that you would consider changing, about the way this *scenario development* phase was conducted (e.g. techniques used, templates for products)?
9. How about the time allowed for the workshop as a whole – did you feel that any part could usefully have been shorter, or longer?
10. Regarding the ideal makeup of the team involved in such an activity – what branches, ranks, organisations, or skillsets do you think should be involved?
11. As a way of 'understanding' possible futures, how does it compare with existing doctrinal techniques (such as, perhaps, the use of a best and worst case variables, as seen during contingency planning in EX NOBLE LEDGER)?
12. We are exploring whether this technique might be useful during the early, *understanding* phase of planning. Are there *other* tasks for which you might propose using it?
13. Do you feel that you would now be able to run a similar workshop yourself? Would any additional support be useful (e.g. analysis tools, collaborative technology, thinking aids, information, etc.)?