

Analysis & Evaluation of the Immediate Reaction Task Force (Land) Command and Control Concept: Applying the COBP

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ABSTRACT

The task facing the analytical team charged with evaluating the novel Command and Control (C2) concept of the HQ Immediate Reaction Task Force (Land) (IRTF(L)) was considerable. This paper highlights the approach taken and documents the analytical and data collection activities taken to utilise the exercises that were used by the HQ while it evolved the Concept. It also highlights a practical example of an attempt to implement the NATO Code of Best Practice for the Assessment of C2 in a real life C2 problem within the constraints of the study. The role played by Wargames, Simulations, Process analysis and Historical analysis in the evaluation are also mentioned.

Key Words: *Simulation, Wargaming, Concepts, Experimentation, Digitisation, Command and Control, COBP.*

1.0 INTRODUCTION

NATO Military Function 01: Command and Control: *“The **organisation, process, procedures** and **systems** necessary to enable timely political and military decision making and to enable military commanders to direct and control military forces.”* (NATO MC, Nov 1996)

Concept Development and Experimentation (CDE) for NATO was proposed at the Norfolk Conference in 1998 and was subsequently launched as part of the Defence Capabilities Initiative (DCI) at the Washington Summit. The NATO Military Committee (MC) tasked Supreme Allied Commander Atlantic (SACLANT) to report on the resource and organisational implications of developing the CDE process within the Alliance (SACLANT, March 1999). To permit a more accurate assessment it was decided that a test case should be used. The test case selected was the novel Immediate Reaction Task Force (Land) (IRTF(L)) command and control concept proposed as a mechanism to modernise the ACE Mobile Force (Land) (AMF(L)) (SHAPE PRX, May 1999). Supreme HQ Allied Powers Europe (SHAPE) was tasked with responsibility for

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the evaluation of the test case. The Operations Research Division of the NATO Consultation Command and Control Agency (NC3A) was asked to lead and provide the necessary scientific support.

The IRTF(L) concept was briefed to the Military Committee (MC) on 14 October 1999. The concept was noted and experimentation of the command and control aspects was sanctioned for a period from 1 June 2000 to 31 May 2001.

A permanent CDE Working Group for the test case was formed with members from the Strategic Commands; SHAPE and SACLANT, the NC3A and Regional Command NORTH. This group activates ad hoc sub-groups when required for specific tasks.

In accordance with CDE guidance, SHAPE produced a concept White Paper describing the concept within an operational context, the experimentation strategy to be adopted and the hypothesis to be tested (SHAPE PRL, Dec 1999). Using the White Paper, the NC3A produced an Experimentation Plan (NC3A, Feb 2000) listing the required analytical tasks and exercises that would be used in the evaluation of the concept, their connectivity and the projected level of effort required.

The experimentation plan was based around the data collected during a series of exercises. A total of three AMF(L)/IRTF(L) Exercises were originally identified and mandated by the MC as the primary vehicle for concept evaluation. Two more exercises, were added to the Experimentation Plan by the CDE Team (NC3A May, Oct, Dec 2000 and Mar 2000). As a result of a SHAPE recommendation and the cancellation of one of the original three exercises the experimentation period was extended until December 2001 by the MC. This allowed two more IRTF(L) exercises to be added to the expanded experimentation plan (NC3A, Sep & 11 Dec 2001).

The final report on the viability of the concept was made by SHAPE and NC3A in Dec 2001 (NC3A, 19 Dec 2001).

The evaluation of this concept was complex. The methods employed by the Analytical Team included; historical analysis, human factors research, the collection of data during Command Post and Field Training Exercises, process analysis, simulation and wargaming (Candan & Lambert, 2002; Lambert & Martel, 2002; Lambert, 2002; Spacie, Storr and Waddell, 2002).

2.0 THE NATO CODE OF BEST PRACTICE FOR C2 ASSESSMENT

From the outset of this project the Analytical Team made reference to the newly published NATO Code of Best Practice for C2 Assessments (RTO, 1999) and also to the summary version – the UK DERA Guide to Best Practice for C2 Assessments (DERA, 1999). Many of the tenets suggested in the COBP were noted by the team and put into practice within the constraints of the project. Some of the immediate lessons identified were also noted and incorporated into the revised COBP, in particular those relating to the participants in the project and the requirement for an iterative approach to problem formulation. This paper will attempt to illustrate the IRTF(L) project against the backdrop and headings of the COBP.

3.0 THE IRTF(L) COMMAND & CONTROL CONCEPT

3.1 ACE Mobile Force (Land)

The AMF(L) was created in 1960 as a rapidly deployable multinational land force to act within NATO's Area Of Responsibility (AOR) as a political signal and deterrent (NATO MC, 1970). Originally envisaged as a brigade group with the strength of approximately 5000, it was composed of a HQ structure designed to command three light infantry battalions supported by the appropriate Combat Support (CS) and Combat Service Support (CSS) elements. In order to operate within the environments of the NATO AOR (including arctic and mountainous), the force pool from which the appropriately equipped and trained force of 5000 would be drawn has expanded over the years to a strength of nearly 19000 troops. HQ AMF(L) is under the Supreme Allied Commander Europe's (SACEUR) direct command with national contributions under national command until deployed. Key elements are at 72 hours Notice To Move (NTM) for Article 5 operations, with the remainder at 7 days NTM. In practice, key elements are ready to undertake operations by G¹+5, the remainder no later than G+13.

The AMF(L) is NATO's unique instrument to project cohesion, solidarity and resolve through its immediate readiness, multinationality, and versatility. It is a highly trained formation ready for deployment in deterrence operations, conflict prevention, humanitarian missions and peace building operations. Its diverse and truly multinational force pool assets gives it great flexibility as well as the ability to be tailored for different situations and to undertake varied tasks.

3.2 The IRTF(L) Concept

The proposed a new concept for the AMF(L) is entitled the Immediate Reaction Task Force (Land) (IRTF(L)) (SHAPE PRX, May 1999). The overall aim of this concept is to provide SACEUR with a credible and immediately available multinational force, of up to division in size, which can intervene, as appropriate, in both Article 5 and non-Article 5 crisis response operations (CRO) as directed by SACEUR.

The IRTF(L) can deploy its lead elements within 72 hours and be operational on the ground with a HQ and lead companies within 7 days and be operational in 14 days with six manoeuvre battalions, followed by the entire division-size IRTF(L) in place within 3 weeks. Once deployed the IRTF(L) can function in a variety of roles from an independent initial entry force to an enabling force for a larger formation. IRTF(L) represents a credible military force and political tool that demonstrates the solidarity and resolve of NATO in all types of operations.

The IRTF(L) concept is predicated on the enlargement of AMF(L) from brigade size up to division size with a single streamlined headquarters and a chain of command using Task Groups.

The amalgamation of the division and brigade level HQs will result in significant savings in HQ support personnel and infrastructure requirements. In addition there would be personnel savings, as only approximately 255 HQ staff would be required for HQ IRTF(L)² as opposed to the 320 required for a traditional HQ structure of three brigade HQs and one divisional HQ. Utilising a significant degree of augmentation, the HQ Peace Establishment (PE) would be designed to provide the nucleus for rapid deployment up to brigade level, whilst retaining the ability to expand to command a division level formation

¹ G Day is the day the NATO Activation Order (ACTORD) is issued.

² Figures of 200 and 270 can also be used – depending on how the staff of the HQs concerned are categorised and counted.

when required. To enable this however small increases in the current Peace Establishment (PE) of the AMF(L) and major increases to the Crisis Establishment (CE) would be required. The fully manned IRTF(L) would operate on a mix of $\frac{1}{3}$ PE to $\frac{2}{3}$ CE.

The HQ concept will be empowered by information technology, thereby solving the span of command problems. The information sharing, message handling and common situational awareness through the use of a Battlefield Management System (BMS) will be implemented within the two levels of HQ IRTF(L) and also within the Bn Command Posts (CPs). To enable this, tactical communications of longer range than currently available to traditional brigade or divisional sized formations will need to be used (perhaps utilising satellite communications to overcome line of sight challenges) to allow communication from the divisional HQ directly to the battalions and divisional troops.

The IRTF(L) concept proposes a restructuring of AMF(L) to provide an organisation that has the flexibility to grow from a brigade to a divisional sized force. The HQ Command and Control (C2) is of a modular design with Task Groups (TG) responsible for the planning and controlling of ground manoeuvre units. TGs A-C operate as cells within the divisional Joint Operations Centre (JOC). Some TG staff are also integrated into the division staff as illustrated in figure 1 below. All CS and CSS remain controlled at divisional level. The current G Staff nomenclature should be changed to a Joint prefix indicating a divisional level of command with an inherent capability to plan for and control joint assets within an assigned area of operations.

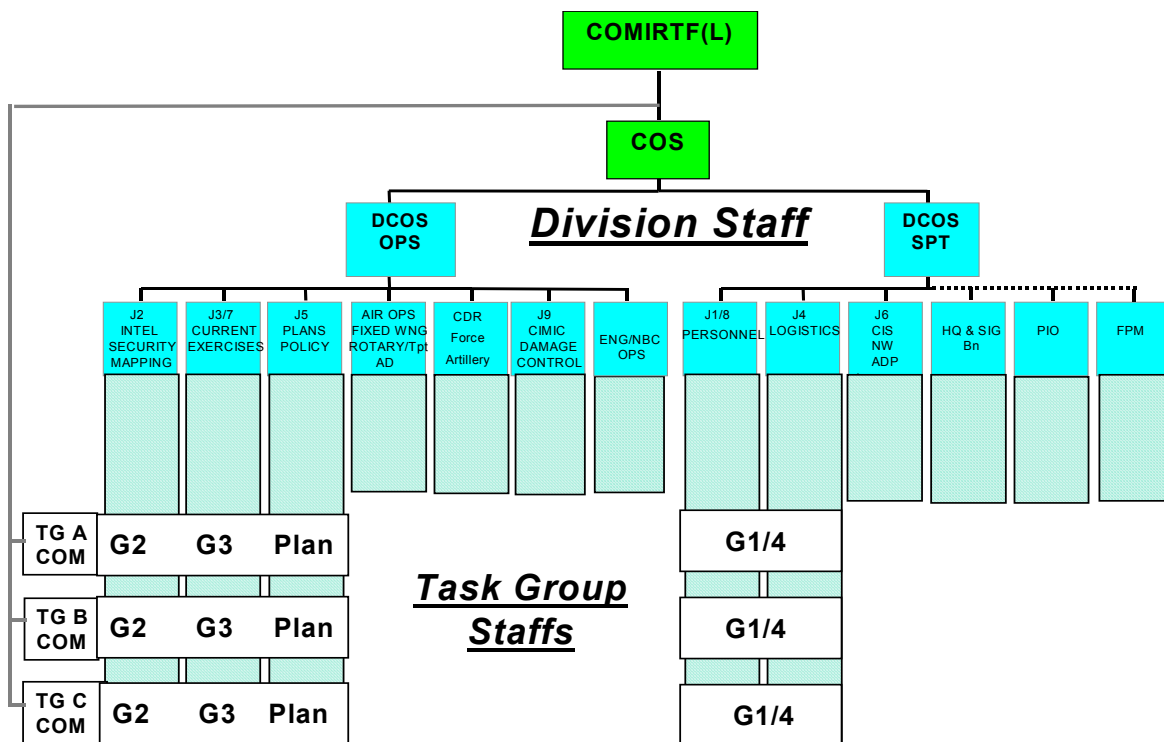


Figure 1: The IRTF(L) HQ Organisation.

Figure 2 illustrates the overall IRTF(L) structure with the manoeuvre TGs, Divisional Troops (responsible for force protection, deep attack, combat support and combat service support), and the Headquarter and Signals

battalion. Echeloning heavier combat assets such as mechanised and armoured units can further increase the capability of the formation as and when needed.

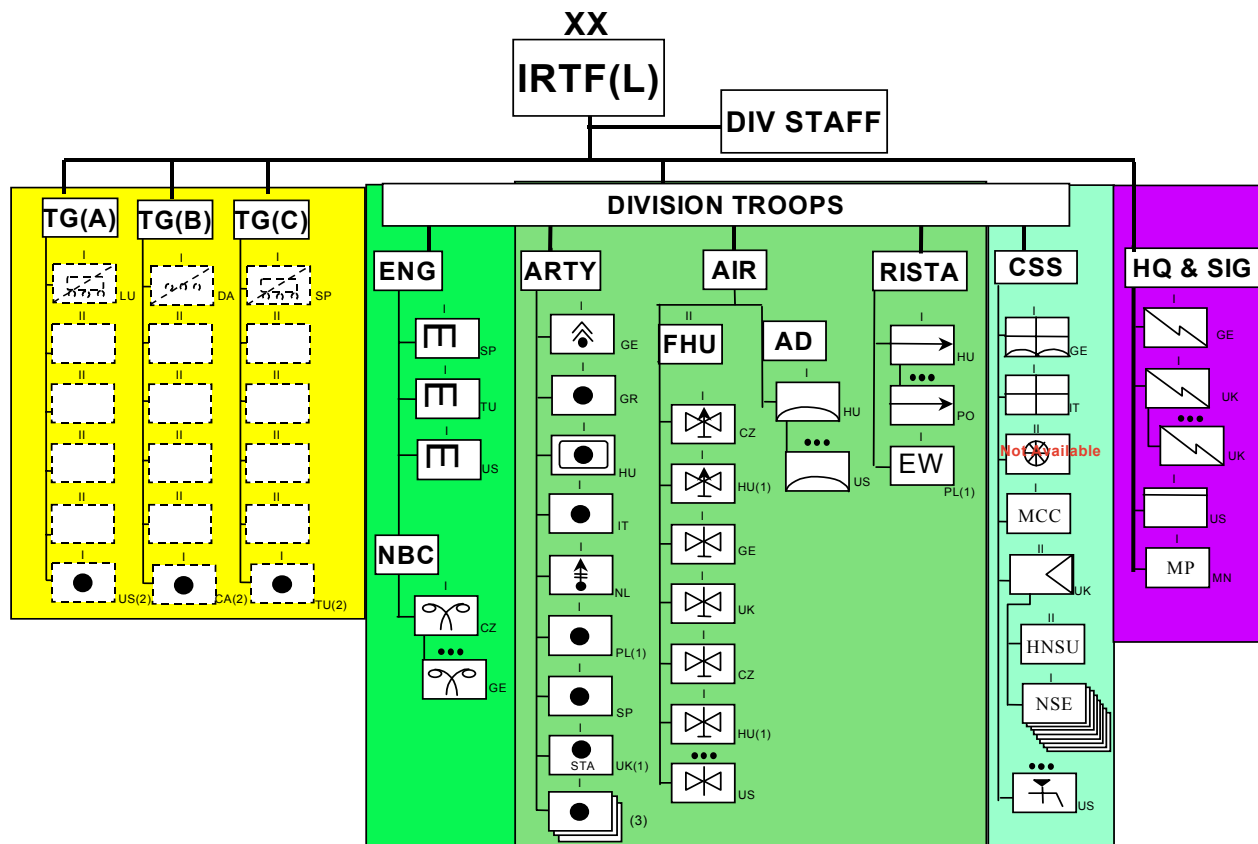


Figure 2: The IRTF(L) Task Organisation.

In summary, the key points to this concept are:

- a) Flattened Headquarters structure:
 - (1) Increased span of control, from 3-5 Infantry Battalions to 9-12 Infantry Battalions.
 - (2) Task organised to provide a wide spectrum of utility.
 - (3) Without increasing the staff size to the requirement of conventional structures.
- b) Digitisation
 - (1) Battle Management System (BMS), allowing a common view of the battlefield, from battalion to division.
 - (2) Use of technology to expand span of control.
 - (3) CIS and SATCOM to resolve challenges of span of command and control and range of communications, to cover increasingly disparate forces.

4.0 PROBLEM FORMULATION

Problem formulation was a continuous process throughout the life of this project (as is indicated in the COBP). It is probably fair to say that it was only after a year of looking at the problem that the team fully understood the problem space. This coincided with a revision of the solution strategy, the tools, methods and data used and the expertise used to support the Analytical Team. The essential elements of the formulated problem are, a precise statement of the question, and a list of the independent variables and High Level Measures of Merit (MoM). A full understanding of the assumptions and constraints on both the problem and the circumstances of the project are also required. With respect to this project these are below.

Using the CDE approach, the IRTF(L) C2 Concept evaluation required testing of a hypothesis built to reflect the objective of the concept. The Study Team developed the following hypothesis for the purposes of this study:

“By structural redesign, procedural modification and exploiting CIS innovation it is possible to create a multinational HQ that fulfils both brigade and division level C2 functions, and that is capable of conducting crisis management and crisis response operations.” (SHAPE PRL, Dec 1999)

Testing of this hypothesis involved assessment of a subject in which three sets of variables changed simultaneously. These sets are; the mission spectrum, the organisational structure and the technology. This concept suggested that the IRTF(L) mission spectrum was to enlarge, with operations of different nature compared with that of AMF(L)'s. The HQ organisational structure, including its manning and procedures, needed to change significantly to reflect the requirements and aspirations of the new C2 concept. The third set of variables related to the introduction to the HQ of a BMS and SATCOM capabilities. During this evaluation the HQ organisational structure was the main variable. This was because the mission spectrum variable was able to be largely kept still for the duration of the trial, through the HQ AMF(L) exercise programme (which concentrated on traditional warfighting Article 5 Operations). Additionally the technological variable could also be kept still. This was achieved through:

- a) The introduction of the current version of the Royal Netherlands Army Integrated Staff Information System (ISIS). The BMS and Tactical Messaging System (TMS) were loaned (with training and equipment) to the HQ AMF(L) for the duration of the trial. No significant changes to the capabilities offered by the BMS and TMS were made during the trial.
- b) The simulation of the desired communications capabilities during the exercises. This was achieved through the use of landline in the place of SATCOM and the enhancement of the AUTOKO 90 radio to a bandwidth of 64kbps. This allowed battalion CPs to access to the same databases and servers as the division and TGs.

The time frame for the evaluation was tight. The mandate for the evaluation was to commence from the notation (14 October 1999) and the trial (in which there was something tangible to evaluate) was to last from June 2000 and report at the end of May 2001. This was later extended to December 2001.

Although the IRTF(L) C2 Concept was clearly described in outline, the CDE Analysis Team were surprised to discover after the commencement of the study that the description of the concept (SHAPE PRX, May 1999) was the only documentary record. Consequently the detail required for evaluation (and also for implementation by the HQ) was not available. As a consequence the Analytical Team were faced with the need to develop an objective method to collect data from and to evaluate an evolving concept.

At the beginning of the trial the AMF(L) was a light brigade HQ, equipped and operated in the traditional manner (circa 1970). In the period between the initial preparatory exercises (March and May 2000) and the first IRTF(L) exercise ADVENTURE EXCHANGE 2000 (Sept 2000), the HQ AMF(L) had to be transformed into HQ IRTF(L) (circa 2000). This involved considerable effort from the HQ staff and external NATO and national agencies:

- a) Identification, reception and integration of the additional Voluntary National Contributions (VNCs) into the Peace Establishment (PE),
- b) Bids for and reception of the additional Crisis Establishment (augmentees).
- c) Complete re-design and (in some cases re-equipment) of the structure of the fielded HQ Tactical Operations Centre (TOC).
- d) Rapid introduction of the ISIS CIS into the IRTF(L) TOC and battalion CPs, and a rapid training programme for the PE and CE on ISIS.
- e) The establishment of the exercise communications to simulate the “future” communications.

The HQ AMF(L) is (as has already been explained) part of the Immediate Reaction Forces. As such it is on very short notice to move and needs to train with its subordinate units almost continuously. Throughout the trial the PE core of HQ IRTF(L) remained on an operational status (as the brigade sized AMF(L)), and thus the experimentation was conducted on an operational HQ.

As the reader may have already noted, this concept was mandated by the MC to be evaluated using the AMF(L) training exercises as the primary vehicle. These exercises occur two to three times per year from winter training in Norway to the plains of Greece and Turkey. They range from full scale brigade sized field training exercises (FTX) to command post exercises (CPX) – which may be also field based. The practical issues in organising, transporting, training and administering an *ad hoc* exercise evaluation team on such exercises should not be underestimated.

The CDE team was completely *ad hoc*. Team membership varied considerably throughout the duration of the project – although thankfully the core (the project leader from SHAPE and the two NC3A analysts) remained static. Support was sought for and generously provided from many quarters, the Observers were recruited and mustered by Regional Command NORTH from its subordinate commands, analytical and observer staff were provided throughout by DERA/DSTL and for the exercises by US Joint Forces Command and the German National Defence University. Data collection software support was initially provided from SACLANT³. Project funds were requested from and sometimes provided by both Strategic Commands (SHAPE and SACLANT). These were used for contractual support.

As part of the problem formulation phase(s) of the study, the Analytical Team conducted Red Teaming of the overall concept and also reviewed experiences in the removal of a level of command (Spacie, Storr & Waddell, 2002). The relevant period was from WWII onwards. The conclusions from this series of historical analyses were that:

- a) Rarely – if ever, has a HQ concept been fully developed and tested before being imposed.
- b) Where significant structural changes have been made, they have usually been imposed by decree from above. Such changes have also only ever been accompanied by broad organisational and procedural guidance.

³ HQ SACLANT Programs & Research Branch (HC-53) – SACLANT OA.

- c) Human – NOT technological issues dominate. This includes staff responsibilities, relationships, continuity, training and teamworking issues. In nearly all of the examples – these human issues were overlooked when imposing organisational changes on HQs. In trials following the reorganisation – it was these human issues that forced the rejection of the concept. The biggest reason seems to have been Span of Command.
- d) Where new technology was part of the new concept – the novel HQ concept would almost always be rejected before the new systems were properly introduced. It seems however, unlikely that technology would have stopped the rejection of the concept – but might have mitigated some of the problems.
- e) It was rare that staff roles and the pressures acting on staff as a result of the structural changes were ever reviewed.
- f) There is a strong suggestion that the size of a HQ is inversely proportional to its effectiveness.

The problem facing the Analytical Team was multi-variable, multi-faceted and required multi-disciplinary approaches. In addition, the IRTF(L) C2 Concept had the characteristics of being multi-national and multi-organisational, with multiple stakeholders.

5.0 SOLUTION STRATEGY

The MC had directed the use of AMF(L) and IRTF(L) FTX and CPX for the evaluation of the IRTF(L) C2 Concept. These were training exercises with the primary aim of training the components of the AMF(L) force pool. The initial Experimentation Plan (NC3A, Feb 2000) was produced to gather together other activities (including simulation) to support this exercise centric approach. The initial method used by the Analytical Team was to try and directly measure the Measures of Merit (MoM) on exercise (as this was the primary vehicle for evaluation). In particular the intent was to try and objectively measure the Product Assessment MoM such as timeliness and quality. Directed observations backed up by structured interviews with customers of the HQ processes were therefore used throughout the study to gather information that would lead to an evaluation based on these MoM.

Rapidly however, as the CDE team gained experience in data collection and also worked further on the problem formulation, the MoM associated with the viability and sustainability of the processes of the HQ became more important. After the first IRTF(L) exercise in September 2000 (ADVENTURE EXCHANGE 2000) the solution strategy was adjusted to become more simulation centric. This methodology is schematically depicted in Figure 3. The major components of the method were:

- a) Process Definitions. As the HQ processes and organisation evolved during the initial two IRTF(L) exercises, the Observers were used to collect the process information in the form of schematic diagrams and data (i.e. for each task, the resources and information used, location, duration, predecessor and successor activity were recorded). These process diagrams and data collected were then analysed and fed back to the HQ for review. Following a series of collective workshops an agreed working set of processes was reached with the HQ staff. The Commander IRTF(L) then halted further development of the HQ processes and organisation. This set of steady state processes were used in within the solution strategy:
 - (1) As reference for the creation of HQ Standard Operating Procedures (SOP)⁴.
 - (2) As a data source for the HQ process simulation.

⁴ Several HQ branches used the diagrams or subsets of the diagrams as the SOPs.

- (3) As a reference for the observers in the final exercises to check adherence to the SOPs.
- (4) To create “job descriptions” for the HQ staff (i.e. a listing of process elements by resource). These were of particular utility to the observers in the final exercise.
- b) Process Simulation. A discrete event simulation model was developed to simulate the HQ “trigger-process(es)-product” cycle and to evaluate the workload of staff. The model developed was scenario a-specific. The processes and resources simulated were selected through analysis in parallel to the HQ process workshops. In essence the main processes of concern were those that crossed functional areas – and those resources (HQ staff) involved in them. Staff represented within these areas were either directly involved in the cross functional processes, deputising or providing key support. Other processes and resources simulated were modelled only to the extent to represent their ability to pull the resources of concern (around 80 key posts in the HQ) out of the key processes. The scenario specific triggers and descriptors on these HQ processes were identified and prepared as scenario input files. The simulation enabled measurement of the HQ functional area and individual staff officer workloads, the duration it took the HQ to produce its main products (while a number of different processes were being executed), and the potential bottlenecks in the HQ. These results could be split into scenario and scenario independent effects. The other key utilities of the simulation were to gain an understanding of the dynamics of the new HQ and at the end of the study – to place the Observers at points of concern in the final exercises.
- c) Wargames. In order to populate the simulation scenario input files, statistics on the triggers and descriptors of the HQ Processes needed to be generated and collected. Three wargames were conducted. The method developed was manual, producing results only to a level of detail required to identify which HQ processes would be triggered. The gaming method was implemented as an event stepped game – resulting in a series of briefings to key HQ Staff of a developing situation. Following a tactical deliberation, the processes that would have been triggered within the HQ were recorded and skeleton products such as fragmentary Orders and Operational Orders were produced as input back to the game. The resulting series of triggers and other data were subsequently analysed and used to derive a scenario specific operational tempo for the Simulation. This information was also used as advice on the appropriate operational tempo required for the STAFFEX and final Exercise in Turkey.
- d) Historical Analysis. In order to confirm the performance of the HQ IRTF(L) in warfighting CRO, historical analyses were also conducted to complement the data derived from wargames and exercises. The historical cases selected for this purpose were from the Land Campaign of the Falkland Islands operation in 1982. Using the original divisional, brigade and battalion/commando HQ Logs, a database was populated with the frequency of tasks that were submitted to brigade and division during the operation. These were then mapped onto the triggers of the HQ processes of the IRTF(L) to produce a scenario specific operational tempos for the simulation.
- e) Expert Judgement. Throughout the study the simulation results and observations conducted during the exercises were complemented by expert judgment. These were from experts in command function and in the human factors relevant to IRTF(L). The most of the observers were also Subject Matter Experts (SME).

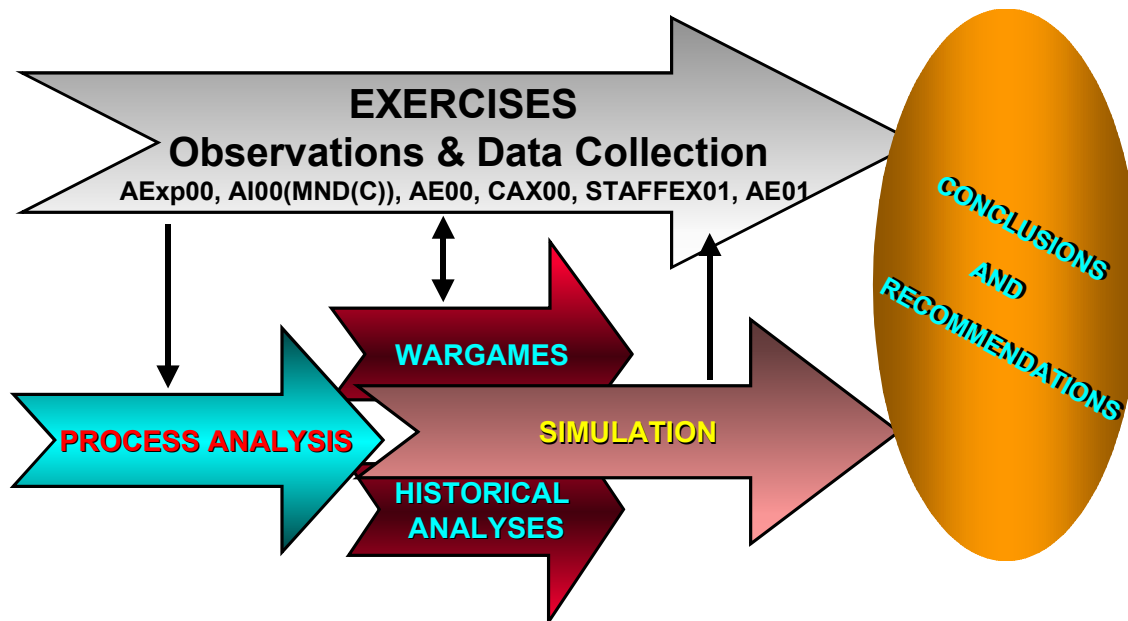


Figure 3: Study Methodology.

6.0 MEASURES OF MERIT

MoM were required to test the study hypothesis. One option was to only evaluate the overall performance of the HQ in terms of its effectiveness in relation to the performance of conventionally structured HQs. This approach alone was found to be of limited value. It was expanded to include the evaluation of the internal mechanisms of the HQ, and its overall performance.

The purpose of a HQ is to produce products to satisfy the requirements of its customers. The customers are, depending on operational circumstances, the commander, flanking, superior and subordinate formations, and other organisations. 'Products' take different forms, but could, for example, include as recommendations to the commander in his decision making, reports to higher commands, orders to subordinate commands etc. The HQ products are produced by the execution of a series of staff processes (situation assessment of the available information, preparing and staffing directives, course of action analyses etc). These processes are triggered by events (new mission, change in enemy forces, change in operational situation, etc). The HQ Staff executes these processes according to established SOPs.

By measurement of this 'trigger-process-product' cycle, a series of MoM can be developed that will ultimately help link the new C2 structure with the quality of the 'products', and thereby indicate the viability of the concept. The major MoM used in this study can be divided into two levels:

- a) Product assessment (i.e. Customer Satisfaction).
 - (1) Product timeliness to meet operational requirements (MoCE)⁵.
 - (2) Product quality in terms of its content, accuracy, relevancy, etc (MoCE).

⁵ Using the MoM Classification of the NATO COBP: MoCE = Measure of C2 Effectiveness – showing the impact of the C2 System within the operational context.

- b) Command function and internal staff processes (i.e. viability and sustainability of HQ processes).
 - (1) Compliance with the Principles of Command (MoP)⁶.
 - (2) Compliance with the Organisational Principles (MoP).
 - (3) Staff Workloads (MoP).
 - (4) Compliance with SOPs (MoP).
 - (5) Co-ordination opportunities between different command levels (MoP).
 - (6) Co-ordination opportunities between different HQ functional areas (MoP).
 - (7) Degree of Situational Awareness (MoP).

Although there are strongly implied links between the two levels, direct causal links are not clear. For example, systemically high staff workloads in specific posts coupled with poor systemic opportunities for co-ordination between specific functional areas in the HQ, will almost certainly produce poor quality and late products – how many of these bad products however will actually affect the operation and to what magnitude is very difficult to establish⁷.

Most of the MoMs above however are measurable individually. Within the above solution strategy the simulation helped establish b(3) directly whilst assuming that b(1, 2, 4, 5, 6, and 7) were conducted perfectly. Using the output of the simulations the wargames could also help establish a(1), whilst assuming all other areas were conducted perfectly. Process analysis also allowed an understanding of b(5) and b(6). Expert Judgement was used for b(1) and b(2). However, the only way to bring all of the MoMs together was in the live situation of the final two IRTF(L) exercises (NC3A, Sep & Dec 2001). In these, data collection and interviews with the customer's of the HQ processes provided the primary MoCE (a(1) and a(2)), whilst observation within the HQ proper at key points and resources – as identified by the simulations – provided data and SME assessments for the MoP.

7.0 HUMAN FACTORS AND ORGANISATIONAL ISSUES

The human and organisational implications of the IRTF(L) C2 Concept were the central issue that the Analytical Team tried to address in problem formulation and solution strategy. The human issues implied by the new C2 Concept were:

- a) An increase in the span of command (although potentially mitigated through the use of TGs).
- b) An increase in the size of the area and distances over which leadership has to be exercised (i.e. the superior command visits to battalions and divisional troops).
- c) An increase in the span of control (especially with respect to the divisional staffs controlling the increased divisional troops and receiving the combined reports and intelligence directly from the 9-12 battalions and divisional troops).
- d) The introduction of the requirement for some HQ Staff to have to simultaneously think at two levels of detail (brigade and division).

⁶ Using the MoM Classification of the NATO COBP: MoP = Measure of Performance – focus on the internal system structures, characteristics and behaviour.

⁷ From observations during the exercises some poor quality and late products have the potential to have catastrophic effects.

- e) Changes to the organisational structure of the HQ (i.e. the introduction of a “J” Staff structure, the use of 2x DCOS, a COS, TG Commanders, the embedding of TG Cells into the JOC, the incorporation of TG officers into divisional functional areas and the establishment of an Offensive Support Group).
- f) Changes to the procedures of the HQ (i.e. the introduction of parallel planning processes and parallel adjustment procedures between TG and divisional levels in J3 and J5).
- g) Introduction of new technology (with the required training overhead and radical change in culture from 1970s to 21st Century methods of sharing information).
- h) Changes to the size of the fielded HQ – from a staff of around 75 (AMF(L)) to 255 (IRTF(L)).
- i) Changes to the balance of permanent staff in the fielded HQ from the AMF(L) ($\frac{2}{3}$ PE: $\frac{1}{3}$ CE) to IRTF(L) ($\frac{1}{3}$ PE: $\frac{2}{3}$ CE).

As historical research had revealed that Human Issues were the prevalent factor in the rejection of novel C2 concepts, attempts were made initially to incorporate human issues into the HQ process simulations, to allow the investigation of these issues under “controlled” conditions. Human factors were studied to establish what human issues should be, or could be, represented explicitly within any process simulation of the HQ. The data were categorised into whether the factor acted on the commander or the HQ Staff (or both), the relative importance the factor would have when IRTF(L) echeloned from brigade sized force to a division. The data were also assessed on whether each factor could be represented within a simulation, or whether a static comparison or the use of Military Judgement/best practice would be best used. In most cases the data identified proved to be impractical (impossible) to collect/define and reliably relate to the relative influence on the HQ processes. Apart from data types such as frequency of task arrival and number of subordinates, all other factors (such as the impact of knowledge and experience of the staff, training level and familiarity of augmentees) would have to be left to SME judgement by the observers on the final two exercises. This key finding clarified the role of simulation to that of simply providing the evidence of workload and complexity of tasks faced by individuals – and to the identification of bottlenecks.

All of the above human and organisational implications of the IRTF(L) C2 Concept were investigated during the study – in particular these were studied by the observers and consultants whilst on the exercises.

Throughout the main evaluation period the command team and senior key HQ Staff remained in post. This provided a valuable constant to the study – as command style (organisational and risk styles) and orders style (degree of detail given to subordinates etc) can vary considerably. The randomness induced to the HQ’s performance from exercise to exercise with respect to the presence of ever-changing augmentees however, should not be underestimated (and in this case provided the biggest single variable).

8.0 SCENARIOS

The main source of scenarios for the study were the AMF(L) training exercises. The terrain types, OPFOR capabilities, type of operations and tempo of these scenarios did not however always reflect the characteristics of the capabilities of IRTF(L) or the operations that it was projected to have been employed in. This was a factor that was outside the control of both the HQ and the CDE Analytical Team.

With respect to the scenarios used by the wargames the original intent was to address this problem and utilise vignettes from the collection of NATO Bi-SC Defence Requirement Review (DRR) scenarios, as these would provide the breadth of scenario conditions, OPFOR characteristics and environments that the IRTF(L) could have been employed in. Unfortunately, due to the gruelling exercise schedule of HQ AMF(L) there was no

time available for the HQ Staff to conduct the additional work to prepare for anything other than vignettes developed within the scenarios of the forthcoming exercises. Using these exercise scenarios therefore, situations that were as realistic as possible to the capabilities of the IRTF(L) were developed for the wargames by the military staff supporting the CDE Analytical Team.

The Analytical Team were however, determined to try and confirm the performance of the HQ IRTF(L) in war-fighting CRO. Therefore historical analyses were also conducted on the Land Campaign of the Falkland Islands operation in 1982. Despite the passage of time this operation was still relevant and contained nearly all the features that the IRTF(L) C2 Concept might encounter in a CRO. The features of importance were: a light infantry *ad hoc* force with limited organic CS and CSS resources, deploying as a brigade sized entry force echeloning to a divisional sized force on a Joint out of area operation of short duration, against a numerically superior enemy.

In summary, although much reduced in scope and number, the scenarios that were studied using the simulation covered a fairly broad spectrum of the IRTF(L)'s warfighting spectrum. The table below summarises the mix of tasks performed per scenario:

Table 1: Light Infantry Formation Tasks Performed in each Scenario

Tasks of a Typical Light Infantry Formation	Wargame 01 Main Defence I 3x TGs	Wargame 02 Main Defence II with restoration of NATO Territory 3x TGs	Wargame 03 Covering Force & Main Defence I 2x TGs	Beachhead and Goose Green. 21-30 May 1982 1x TG	Attack on Port Stanley 11-14 June 1982 2x TGs
F flank Protection	X		X	X	X
Key Point Defence	X		X	X	
Securing a Line of Departure	X	X	X		X
Main Defence	X		X		
Rear Area Security		X		X	X
Infiltration		X			X
Air Mobile Raids		X			
Deception Operations		X			
POW Cages		X		X	X
Security of Lines of Communication		X		X	X
Securing Key Terrain/River crossing	X	X		X	X
Reinforcement		X		X	X
Counter Penetration		X			
Urban Operations		X	X		
Infantry Assault/Attack				X	X

9.0 TOOLS, MODELS AND THEIR APPLICATION

Within the context of the study the majority of tools and methods used in the study were involved in data collection, data generation and collation.

Throughout the study an adapted version of the ACCES methodology (Lambert & Martel, 2002; ARI, 1995; Halpin, 1996) was used to gather the directed observations on exercise. Data were collected by observers using paper collection forms, followed by an end of shift time line debrief to establish a macro view of which processes had been triggered in response to the Exercise Main Events List. This was followed by a period of

detailed transcription into the Observations Collection Program (OCP)⁸. The OCP was used to support the recording, sorting and collation of the observations. It was also used to enable post exercise statistical and quantitative analysis of the data and organised extraction of the qualitative SME statements. Following input of the data into the database the analysts could review the OCP data, attach comments where appropriate and issue new guidance for data collection at the commencement of the next shift. During the last two exercises the activities of individual resources (HQ Staff) were also recorded in the OCP and tracked on a HQ synchronisation matrix⁹.

Due to budgetary constraints no specialist tool was procured to capture the HQ process definitions and conduct simulation. Instead use was made of a spreadsheet, a commercial business process simulation (SIMUL8™) and some simple database applications. The use of the spreadsheet to capture the diagrams and process descriptions was very successful as it enabled HQ Staff to annotate the diagrams and email comments without the problems usually experienced with expensive licensing arrangements in a dispersed study. The series of process analysis workshops used to clarify and consolidate the HQ Processes were most important, enabling a buy-in from the HQ Staff into their own processes and establishing an excellent working relationship with the Analytical team.

The wargaming method to derive statistics for the simulations utilised rules and algorithms recently used in the UK MOD for a variety of tactical studies. This wargame method was simply used to produce a realistic operational tempo and combat resolution. The specialist skills to run the manual game were contracted into the team for the duration of the wargames. During the wargames, the tactical situations were recorded and presented to the HQ Staff using an existing common operational picture capability⁹ at no additional cost. The use of a HQ team-in-the-loop to derive the decision making for input back into the game and to identify the triggering of processes was most successful. It also had the additional benefit of illustrating to the HQ Staff the inter-relationships between their own functional area processes. Data on the HQ Processes were recorded using a simple database and the HQ synchronisation matrix⁹.

In summary therefore, the tools in this study were used to collect data from exercises, workshops and wargames. Where models were used they were either already in existence and validated (the wargaming rules and method) or specially developed to the level of detail required for the study (e.g. the HQ process simulation). None of the outputs of any of these methods were singularly used to provide the definitive evaluation, but rather they were used collectively.

10.0 DATA

As already stated the primary data sources for the evaluation were the FTX and CPX of AMF(L). The use of such events as a means of conducting the C2 assessment had many drawbacks and was well known to the Analytical Team from the outset of the study:

- a) Each exercise produced only one data point (one set of values for scenario/types of operations involved/tempo/etc.).
- b) The training objectives of an exercise often conflicted with the requirements and expectations of the experiment. The artificial characteristics of an exercise, which are essential to meet training

⁸ The OCP was provided to the CDE Analytical Team by HQ SACLANT Programs & Research Branch (HC-53). It was specially adapted by NC3A for the IRTF(L) data collection effort.

⁹ The THISTLE environment, provided by Microprocessor Applications Group, Cranfield University, Cranfield, Bedford, UK.

objectives, may be damaging to the experimentation value. For example, training objectives often require unrealistic adjustments in operational tempo.

- c) Training exercises violate the requirements of experimentation. Typically, from exercise to exercise, too many variables change simultaneously, making the association of cause and effect difficult to identify.
- d) Training exercises are usually of short duration. They do not enable observation of sustained operations (where real C2 problems begin to build up). Additionally, there is no guarantee that the peak levels of work in HQ functional areas or staff processes, are reached.
- e) Equipment, personnel and subordinate unit unavailability may force the introduction of further artificialities. This was certainly true for the AMF(L) exercises.

Despite the above points, the use of exercises did force a holistic look at the problem and allowed interactions between processes, equipment and personnel to be investigated. In addition the relative impact of training levels, augmentees (CE), differing national doctrines, and scenario conditions could also be observed. These were all interactions that would have been impossible to create in a laboratory setting or reliably represent within a computer simulation.

The use of Subject Matter Experts as sources of data was an important feature of this study. Many teams and individuals acted in the capacity of data generation SMEs:

- a) The military observers used on exercise to identify and record HQ process data, gather statistics and to make professional observations on the effectiveness and accuracy of the implementation of the C2 Concept.
- b) The HQ Staff in reviewing and amending the HQ Processes, followed by the production of the HQ SOPs.
- c) The military staff supporting the CDE Analytical Team in helping identify the scenario specific and a-specific triggers within the simulation.
- d) The military staff supporting the CDE Analytical Team in generating the scenarios for the wargames.
- e) The wargame analyst in helping generate a realistic operational tempo and combat resolution.
- f) The HQ Staff acting as a “team-in-the-loop” in the wargame, in helping identify the processes triggered in response to the vignettes presented.
- g) The historical and military analysts in helping identify the operational tempo from the Falklands Land Campaign.
- h) The command and human factors consultants, used to review the findings of the exercises.
- i) The military observers used in the final exercises to monitor the areas of concern as identified by the simulation and the compliance of the HQ staff with the SOPs.
- j) The military observers used to assess the timeliness and quality of the HQ products.

11.0 RISK AND UNCERTAINTY

Unfortunately the solution strategy and its implementation suffered from several limitations. The main methodological limitations were:

- a) A complete coverage of the potential mission spectrum for IRTF(L) can not be claimed. However, the discrete point assessments conducted should provide a sufficient insight to the validity of the IRTF(L) C2 concept.
- b) Only the C2 sub-concept of the IRTF(L) concept was examined. Possible interactions between the C2 sub-concept and the other parts should be taken into account when the study results are used. For example, enhancements in the IRTF(L) force pool may (will) change the nature and frequency of the occurrence of HQ processes, with an inevitable impact on this study outcomes.
- c) This study was exercise-centric. Although augmented by other approaches most of the data used throughout this study originated from the exercises. Exercise artificialities naturally constrain the validity of the study outcomes.
- d) During the exercises the IRTF(L) typically had two TGs in its structure. The full complement was not tested in the field. The simulation and wargames were therefore the only instances where the full concept of three TGs could be observed.
- e) Experimentation of the C2 Concept and its implementation were conducted while the concept was still evolving. Consequently the results of this study can only reflect the assessment of the concept in one stage during evolution (although this was a stable and practical stage).
- f) Only processes relating to J2, J3, J5, Offensive Support and Engineers were modelled. Other functional areas (i.e.. J1, J4, J6 and J9) were excluded from the assessment¹⁰. When the necessary sub-C2-concepts are developed and implemented they may subsequently influence the outcomes of this study.

These limitations can be summarised by what is known in the COBP as an “uncertainty of focus” (i.e. whether the assessment covers all of the important factors and issues). Due to these limitations, the results of this experiment could not be regarded as being totally authoritative or exhaustive. However, they were the best achievable results given the time and resource constraints. The project sponsor and stakeholders were kept aware of these uncertainty issues.

The limitations and uncertainties associated with this evaluation were fully communicated with the final study results to the project sponsor, the stakeholders and decision makers.

12.0 PRODUCTS

Throughout the project the Analytical Team continuously published its findings. This commenced with the CDE white paper and initial experimentation plan (SHAPE PRL, Dec 1999; NC3A Feb 2001). During the exercises the Analytical Team formally reported their findings to the Project sponsor and stakeholders in exercise reports (NC3A, May 2000, Oct 2000, Nov 2000, Mar 2001, Sep 2001, Dec 2001). The results of every workshop were documented and archived for possible future reference. All data collected were also archived and stored centrally for access by all members of the Analytical Team. Prior and during each

¹⁰ The C2 sub-concepts relating to these areas were not developed at the time of data capture – and were not central to the cross functional processes considered.

exercise all process diagrams, SOPs and HQ layouts etc were also made available over the NATO WAN (CRONOS) for the familiarisation of observers and HQ Staff. A final report (NC3A, 19 Dec 2001) and methodology reports (Candan & Lambert, 2002; Lambert & Martel 2002; Lambert 2002) have also been produced.

Once the solution strategy was clear, the Analytical Team wished to have the method peer reviewed. This was however, not possible to arrange formally. The NATO RTO SAS026 working group however kindly allowed the project method to be informally presented to them and gave some valuable advice.

13.0 CONCLUSIONS

13.1 IRTF(L)

The experimentation conducted to evaluate the IRTF(L) C2 concept did not detect any fundamental flaws in the concept. It was assessed to be doctrinally sound and practical.

It was assessed that the C2 Concept is well suited to an infantry formation in warfighting (i.e. both CRO and high intensity Article 5). The concept however has not been assessed for its applicability to other types of formation.

Many problems however, were encountered with respect to the actual implementation of the C2 Concept. The single most important of these was the influence of the HQ manning regime on the quality of the HQ's work. In particular the high proportion of CE (augmentation) staff within the HQ.

What was fielded was the foundation of an operational HQ. There were a few systemic issues that need to be addressed to make it work to the satisfaction of the customers of its processes and many improvements to make it efficient and therefore operational.

All recommendations to enable the C2 concept that were listed at the end of the experimentation were practical and possible, given collective will, commitment, resources and money.

13.2 COBP

As already stated the COBP was used from the outset of the project. The key utility of the COBP to this project were:

- a) To assist the Analytical Team to consider the C2 Concept in as wide a context as possible and also to look at the problem holistically – as per the NATO definition of C2 (organisation, processes, procedures and systems).
- b) To continually try and articulate the problem and recognise the requirement to refine the solution strategy in response to the problem formulation.
- c) To remain aware of the limitations of the solution strategy, and the impact of this on the results.

The COBP lessons learned for the Analytical Team were:

- a) To be much more proactive at the start of a C2 study in rejecting methods (solution strategies) that are forced onto a study (such as the use of training exercises) before the initial problem formulation stage has been completed (or even started!).

- b) To actively question any arbitrary deadlines set on a study – that (as in the case of IRTF(L)) will reduce the possibilities for experimentation and the number of scenarios explored.

13.3 General Lessons

Never again to be involved in an experimentation on an operational HQ – unless the operational responsibilities of that HQ are reduced to allow experimentation.

To question the wisdom of “big-bang” approaches to organisational change and or the introduction of new technology, as these will always produce a sub-optimal solution. The preferred solution strategy of the Analytical Team was to have had a planned methodical evaluated “directed evolution” of the concept. In this, each functional area and cross functional process would have been evolved through a series of “team-in-the-loop” experiments, culminating in a series of full exercises (rather than beginning with them). The imposition of the rapid simultaneous HQ wide evolution that was curtailed before maturity meant that the trace-ability and influence of the different variables could not be properly established and quantified. In essence the Analytical Team was left to evaluate a one single possible working version of the C2 Concept – rather than gaining a full understanding of the factors at work and helping establish an optimum implementation.

14.0 REFERENCES

ARI, (April 1995), “The Army Command and Control Evaluation System – Documentation”, Research Product 95-09, Fort Leavenworth Unit – Manpower and Personnel Research Division, US Army Research Institute for the Behavioral and Social Sciences, Forwarded by Evidence Based Research Inc.

Candan, U. and Lambert, N.J., (to be published), “Methods used in the Analysis and Evaluation of the Immediate Reaction Task Force (Land) Command and Control Concept”, NATO C3 Agency, Ref: TN 897.

DERA, (August 1999), “Guide to Best Practice (COBP) in C2 Assessment, UK Defence Evaluation and Research Agency.

Halpin, S.M., (June 1996), “The Army Command and Control Evaluation System”, Research Product 96-04, Fort Leavenworth Unit, US Army Research Institute for the Behavioral and Social Sciences.

Lambert, N.J. and Martel, S., (to be published), “Immediate Reaction Task Force (Land) Command and Control Concept: Process Analysis and Simulation”, NATO C3 Agency, Ref: TN 895.

Lambert, N.J., (to be published), “Immediate Reaction Task Force (Land) Command and Control Concept: Wargames and Historical Analysis”, NATO C3 Agency, Ref: TN 896.

NATO, (2001), Article 5 of the North Atlantic Treaty, “NATO Handbook 2001”, page 528, ISBN 92-845-0146-6 or <http://www.nato.int>.

NATO MC, (April 1970), “NATO Military Committee – General Directive for Allied Command Europe Mobile Force”, MC137(final).

NATO MC, (November 1996), “NATO Military Committee – Annex B to MC Guidance for Defence Planning”, MC-299/5.

NC3A, (29 February 2000), “NATO Concept Development & Experimentation (CDE) Experimentation Plan – Immediate Reaction Task Force (Land) Command and Control Concept”, NATO C3 Agency, Ref. WP:PL/52/2000.

NC3A, (26 May 2000), “NATO Concept Development & Experimentation (CDE): Observations on Exercise ADVENTURE EXPRESS 2000”, NATO C3 Agency, Ref. WP:PL/53/2000, Limited Distribution.

NC3A, (09 October 2000), “NATO Concept Development & Experimentation (CDE): Observations on Exercise ACTIVE IMPROVEMENT 2000”, NATO C3 Agency, Ref. WP:PL/54/2000, Limited Distribution.

NC3A, (17 November 2000), “NATO Concept Development & Experimentation (CDE): Observations on Exercise ADVENTURE EXCHANGE 2000”, NATO C3 Agency, Ref. WP:PL/55/2000.

NC3A, (23 March 2001), “NATO Concept Development & Experimentation (CDE): Observations on the IRTF(L) Computer Aided Exercise 2000”, NATO C3 Agency, Ref. WP:PL/56/2001.

NC3A, (September 2001), “NATO Concept Development & Experimentation (CDE): Observations on the IRTF(L) STAFF EXERCISE 2001”, NATO C3 Agency, Ref. WP:PL/57/2001.

NC3A, (11 December 2001), “NATO Concept Development & Experimentation (CDE): Observations on Exercise ADVENTURE EXCHANGE 2001”, NATO C3 Agency, Ref. WP:PX/60/2001.

NC3A, (19 December 2001), “Evaluation of the IRTF(L) C2 Concept: Final Report”, NATO C3 Agency, Ref. WP:PX/61/2001.

SACLANT, (23 March 1999), “Study on the Feasibility of Adapting A Process of Concept Development and Combined Experimentation Within NATO”, SACLANT IMSM-276-99.

SHAPE PRL, (23 December 1999), “CDE White Paper: Immediate Reaction Task Force (Land) Command and Control, Experimentation Strategy”, 11023-05-23/SHPRL/99.

SHAPE PRX, (12 May 1999), “Concept Paper: Immediate Reaction Task Force (Land) – A Complete Utility”, 2100/SHPRX/01/99.

Spacie, K., Storr, J. and Waddell G., (to be published), “Immediate Reaction Task Force (Land) Command and Control Concept”, Reports of Consultants, NATO C3 Agency, Ref: Consultant Report 140.

RTO, (March 1999), “Code of Best Practice (COBP) on the Assessment of C2”, NATO Research Technology Organisation, TN 9 AC/323(SAS)TP/4.

15.0 LIST OF ACRONYMS

ACE	Allied Command Europe
AD	Air Defence
AMF(L)	ACE Mobile Force (Land)
AOR	Area of Responsibility

ARTY	Artillery
BMS	Battle Management System
C2	Command and Control
CAX	Computer Assisted Exercise
CDE	Concept Development and Experimentation
CE	Crisis Establishment
CIS	Command Information Systems
COBP	NATO Code Of Best Practice for C2 Assessment
COM	Commander
COS	Chief of Staff
CP	Command Post
CPX	Command Post Exercise
CRO	Crisis Response Operations
CS	Combat Support
CSS	Combat Service Support
DCI	Defence Capabilities Initiative
DCOS	Deputy Chief of Staff
DERA	Defence Evaluation and Research Agency (UK)
Div	Division
DSTL	The Defence Science and Technology Laboratory (UK) (one of the two successors to DERA)
ENG	Engineer
EW	Electronic Warfare
FHU	Force Helicopter Unit
FTX	Field Training Exercise
HQ	Headquarters
IRTF(L)	Immediate Reaction Task Force (Land)
ISIS	Royal Netherlands Army Integrated Staff Information System
JFCOM	US Joint Forces Command
JOC	Joint Operations Centre
LOC	Line of Communication
MC	The NATO Military Committee
MEL	Mail Events List (exercises)
MND(C)	Multinational Division (Centre)

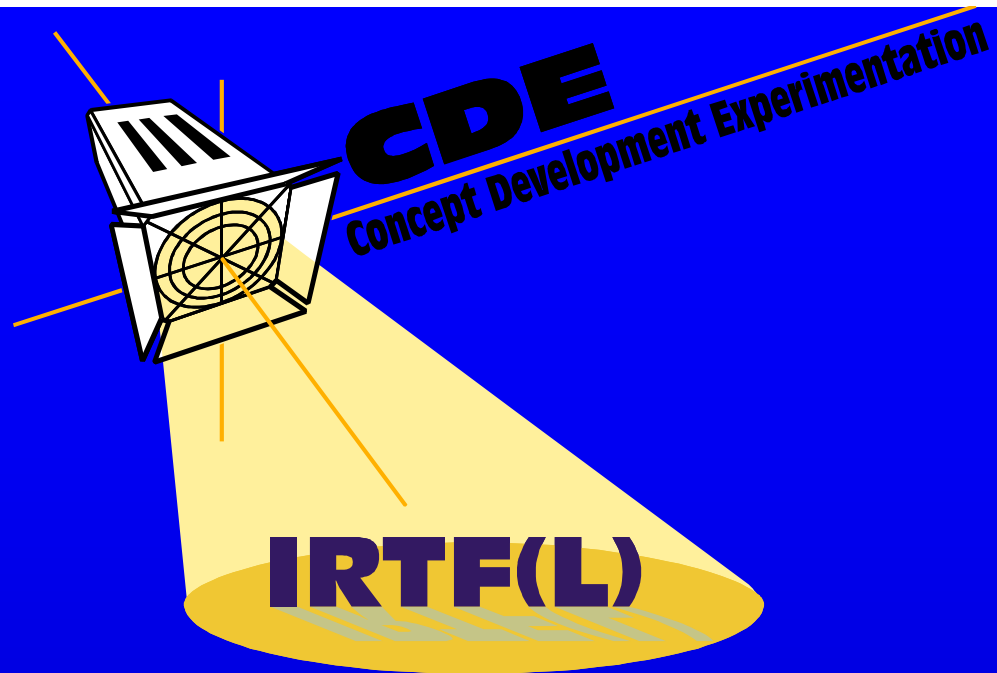
MoCE	Measure of C2 Effectiveness
MOD	Ministry Of Defence
MoE	Measure of Effectiveness
MoM	Measure of Merit
MoP	Measure of Performance
NC3A	NATO Consultation Command and Control Agency
NTM	Notice to Move
OPFOR	Opposing Force (exercises)
PE	Peace Establishment
RISTA	Reconnaissance, Intelligence, Surveillance and Target Acquisition
RTO	NATO Research and Technology Organisation
SACLANT	Supreme Allied Commander Atlantic
SACEUR	Supreme Allied Commander Europe
SATCOM	Satellite Communications
SC	Strategic Command (as in Bi-SC – i.e. SACLANT and SHAPE)
SHAPE	Supreme HQ Allied Powers Europe
SIG	Signals
SME	Subject Matter Expert
SOP	Standard Operating Procedures
STAFFEX	Staff Exercise
TG	Task Group
TMS	Tactical Messaging System
TOC	Tactical Operations Centre
VNC	Voluntary National Contributions
WWII	World War II

AUTHOR BIOGRAPHY

Dr Umit Candan received his BSc and MSc degrees in Mechanical Engineering from the Technical University of Istanbul, and his Ph D in Operations Research from the Istanbul University. He worked as an associate professor in the Business Administration Faculty of the Istanbul University, lecturing and conducting research in Production Management, Operations Research and Quality Control between 1968-1981. At the same time he conducted several industry-sponsored studies in Master plan development for different industrial sectors, the re-organisation of State-owned enterprises, location selection for industrial complexes with multiple production sites and balance of production lines. Dr Candan joined the Operation Research Division of the SHAPE Technical Centre as a Scientist (later to become the NATO C3 Agency)

in 1981. He participated in and conducted several studies for SHAPE using operations research approaches to assess military concepts, force requirements and courses of actions at strategic, operational and tactical levels. He is currently the Chief of the Architectures and C3I Analyses Branch in the Operations Research and Functional Services Division at the NATO Consultation Command and Control Agency in The Hague in The Netherlands.

Mr Nicholas Lambert is a graduate of the University of Wales (BSc Hons Environmental Biology) and Royal Military College of Science (Post Grad Diploma in Military OR). He has worked as an Operational Analyst on a wide variety of military tasks for UK MOD from 1987 to 1999. During this time (1994 to 1999) he was assigned to the Operational Analysis Branch at HQ Allied Command Europe Rapid Reaction Corps (ARRC), which included a 10-month deployment (1995/1996) to Bosnia and Herzegovina as part of the NATO Implementation Force (IFOR). Since 1999 he has worked on Land and Joint C2 issues in the Architectures and C3I Analyses Branch in the Operations Research and Functional Services Division at the NATO Consultation Command and Control Agency in The Hague in The Netherlands.

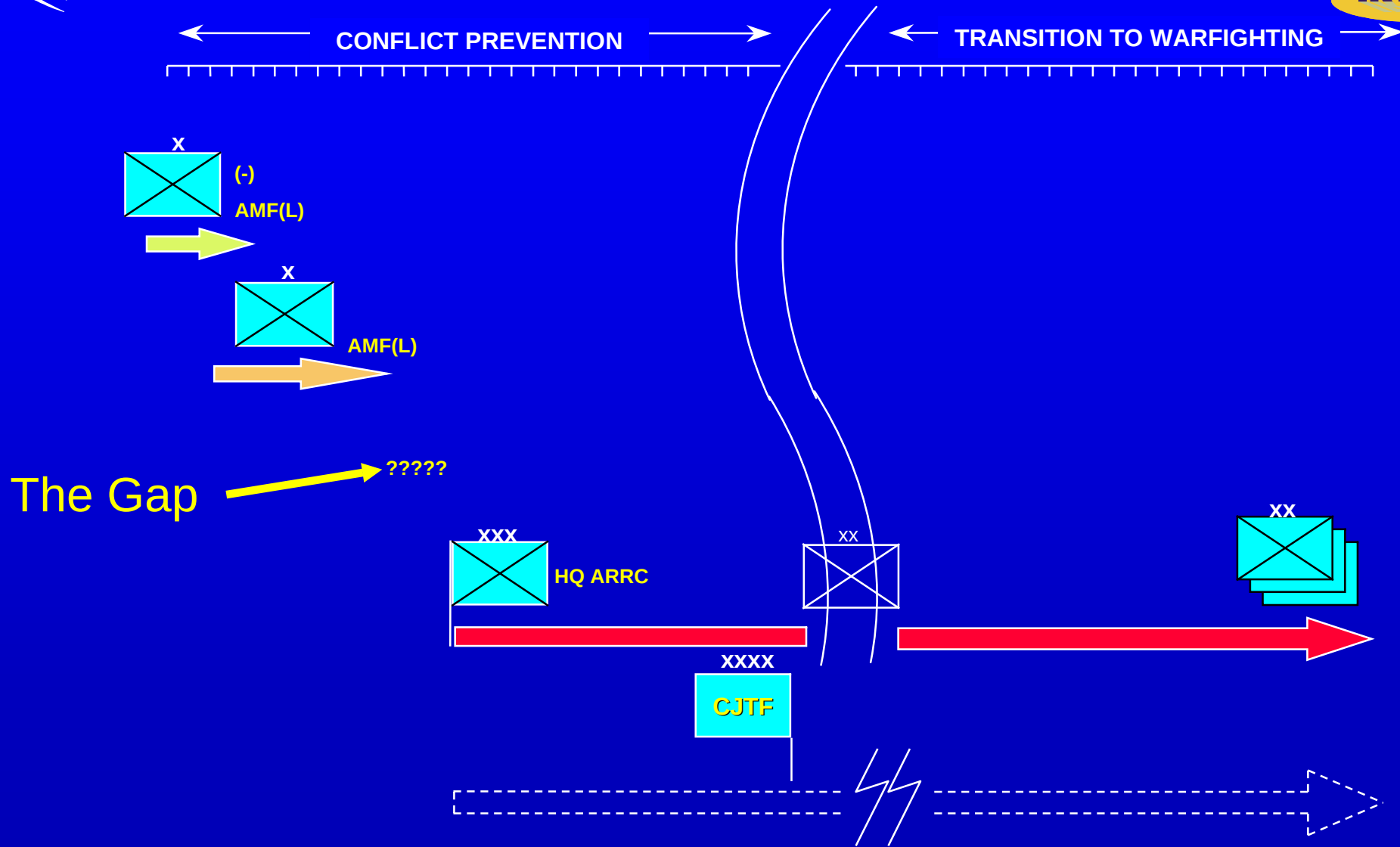
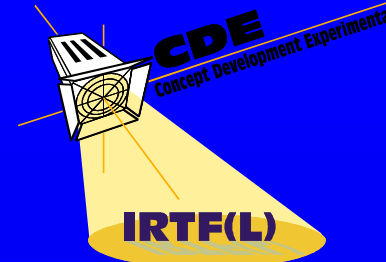


Analysis & Evaluation of the Immediate Reaction Task Force (Land) Command & Control Concept

Applying the NATO COBP for C2 Assessments



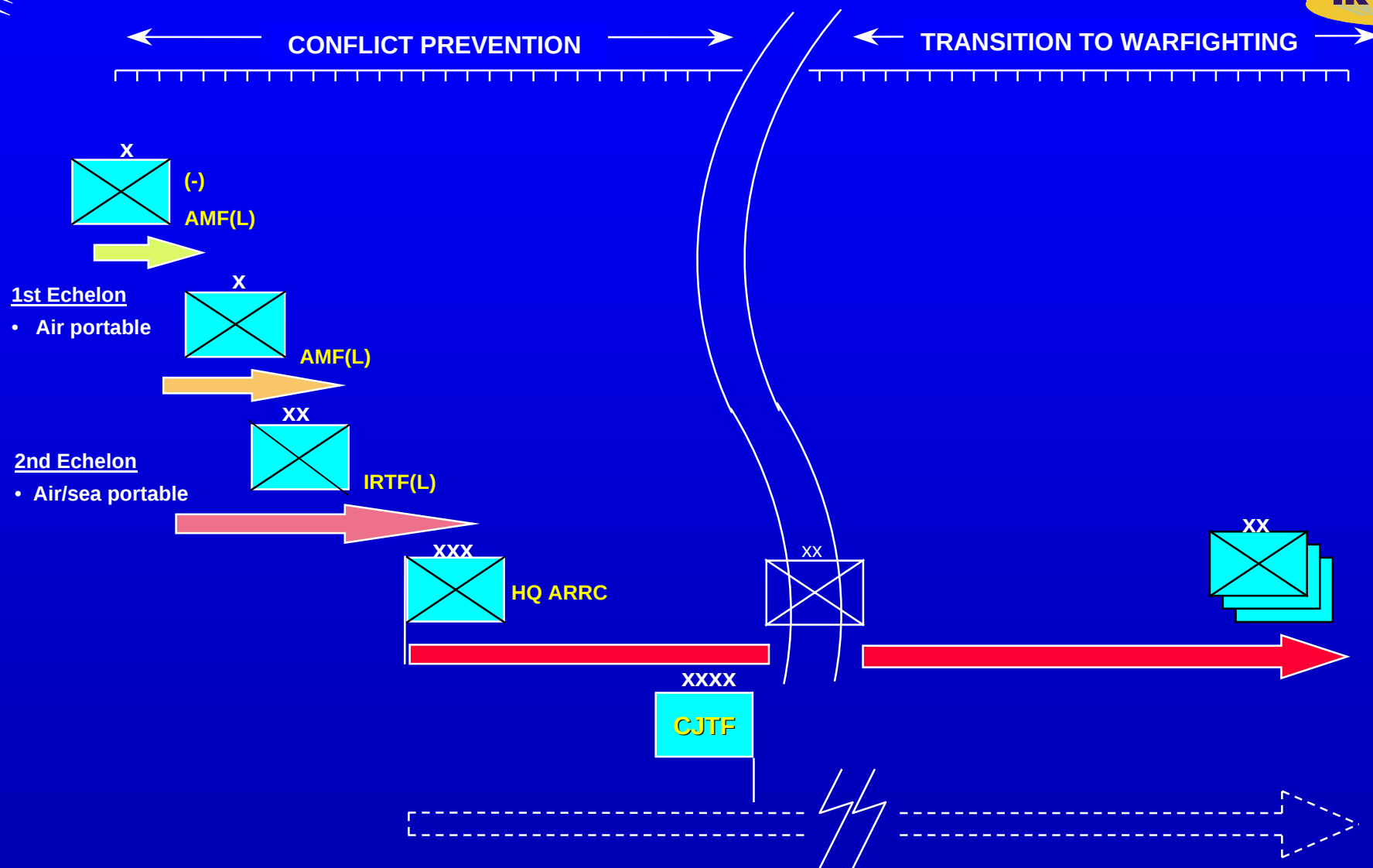
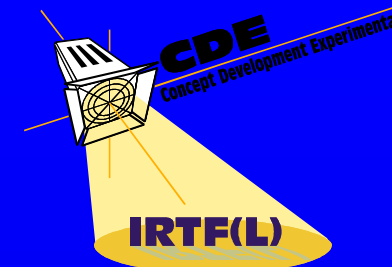
Graduated Response



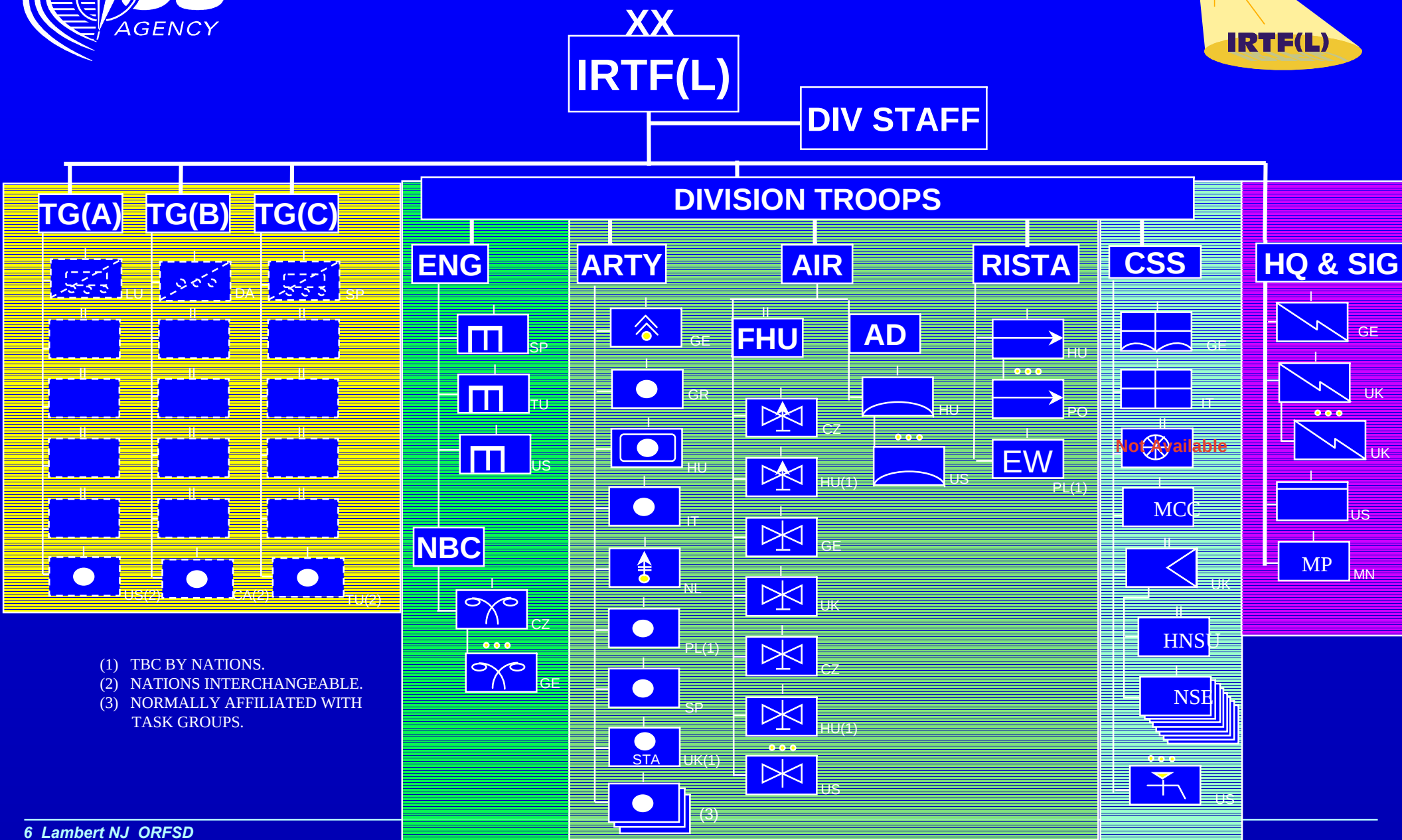
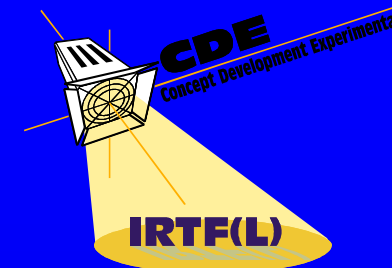




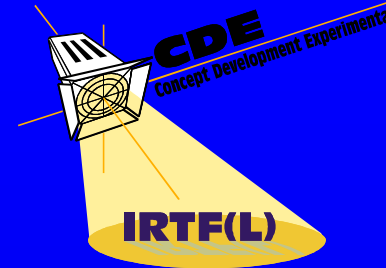
Graduated Response



IRTF(L) Task Organisation



IRTF(L) HQ Organisation



COMIRTF(L)

COS

DCOS
OPS

Division Staff

DCOS
SPT

J2
INTEL
SECURITY
MAPPING

J3/7
CURRENT
EXERCISES

J5
PLANS
POLICY

AIR OPS
FIXED WING
ROTARY/Tpt
AD

CDR
Force
Artillery

J9
CIMIC
DAMAGE
CONTROL

ENG/NBC
OPS

J1/8
PERSONNEL

J4
LOGISTICS

J6
CIS
NW
ADP

HQ & SIG
Bn

PIO

FPM

TG A
Cdr

G2

G3

Plan

TG B
Cdr

G2

G3

Plan

TG C
Cdr

G2

G3

Plan

***Task Group
Staffs***

G1/4

G1/4

G1/4

Manpower Savings

Aprox Divisional and Bde HQ manpower bill :

$$60 + 60 + 60 + 140 = 320$$

IRTF(L) Divisional and TG HQ manpower bill :

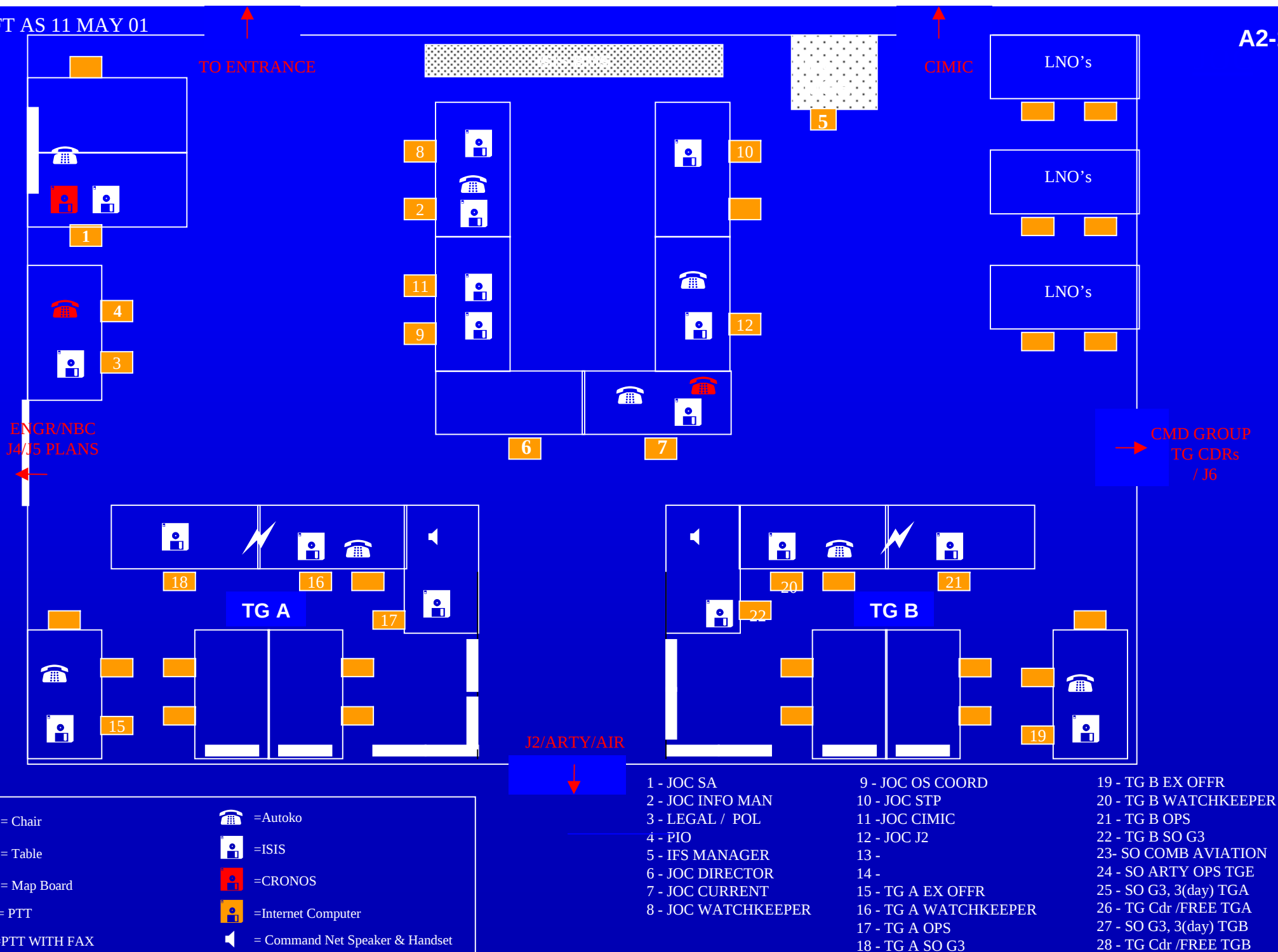
$$18 + 18 + 18 + 201 = 255$$

Manpower Bill

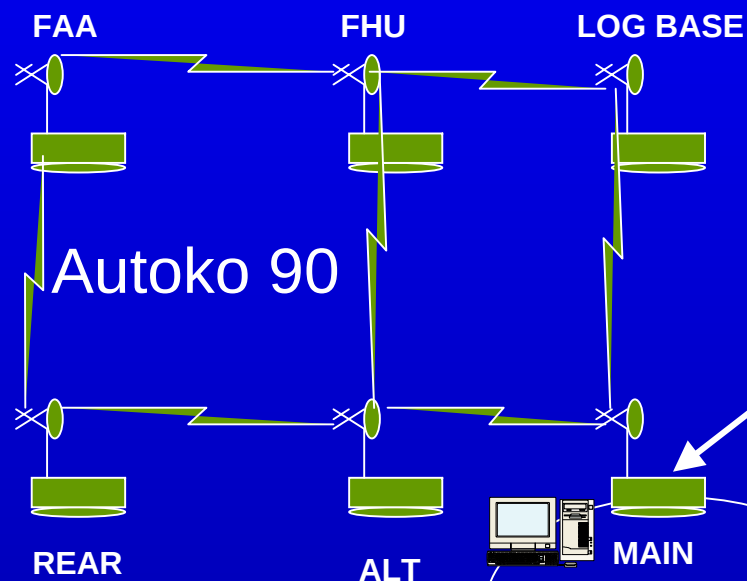
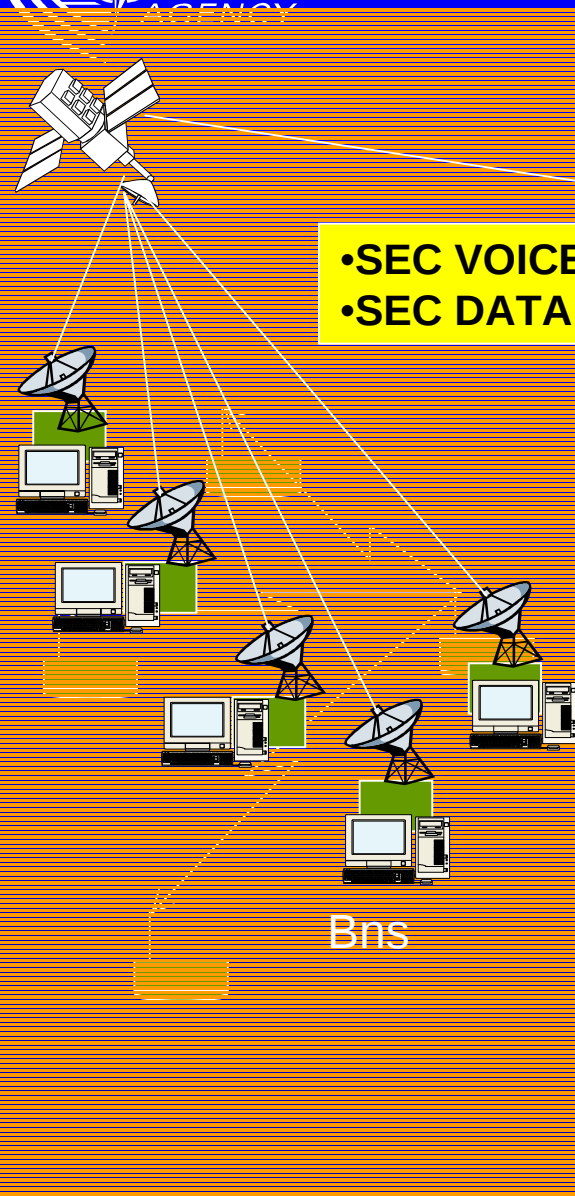
PE AMF(L)	EE AMF(L)		EE AMF(L)
54	21	75	28%

PE IRTF(L)	EE IRTF(L)		EE IRTF(L)
54 + 25	21 + 155	255	69%

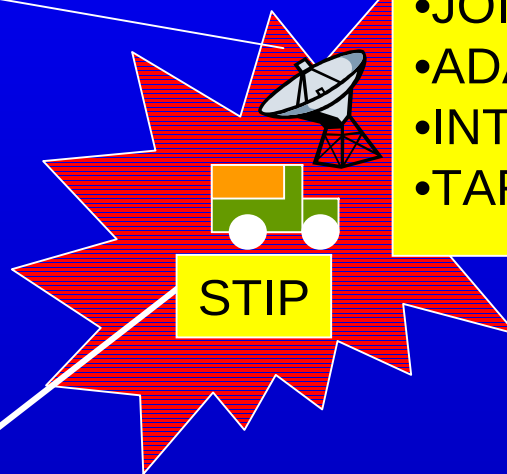
IRTF(L) figures inc the EE for TG C and other unfilled posts



Communications



- SECURE VOICE
- SECURE FAX
- SECURE DATA

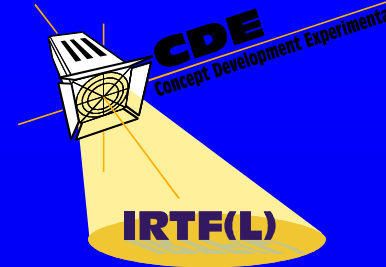


- VOICE
- CRONOS
- ICC
- JOIS
- ADAMS
- INTERNET
- TARE

ICC

IFS

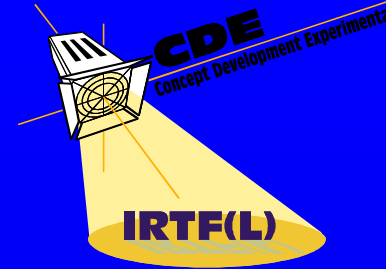
Problem Formulation



“by structural redesign, procedural modification and exploiting CIS innovation it is possible to create a multinational HQ that fulfils both brigade and division level C2 functions, and that is capable of conducting crisis management and crisis response operations”

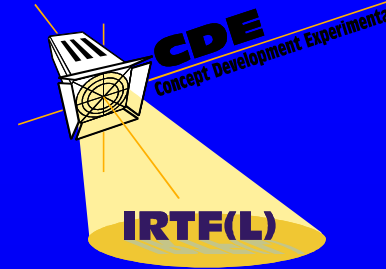
Hypothesis : CDE White Paper, December 1999

Problem Formulation



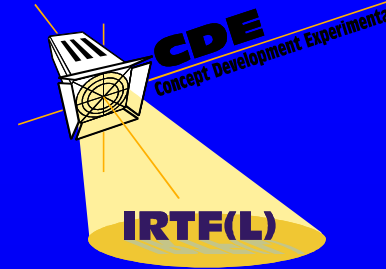
- **Variables**
 - Mission Spectrum
 - Organisation
 - Technology
- **Timeframe**
- **Transforming AMF(L) to IRTF(L)**
- **Operational Status**
- **CPX & FTX**
- **Adhoc CDE Team**

Problem Formulation



- **Red Teaming**
- **Historical Research - Removal of C2 Level**
 - Immediate implementation
 - Imposition
 - Human issues !
 - New technology
 - Workloads
 - HQ size

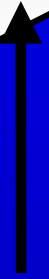
Solution Strategy



- **Phase I**
 - Exercise Centric
- **Phase II**
 - Simulation Centric

Solution Strategy

EXERCISES
Observations & Data Collection
AExp00, AI00(MND(C)), AE00, CAX00, STAFFEX01, AE01



PROCESS ANALYSIS

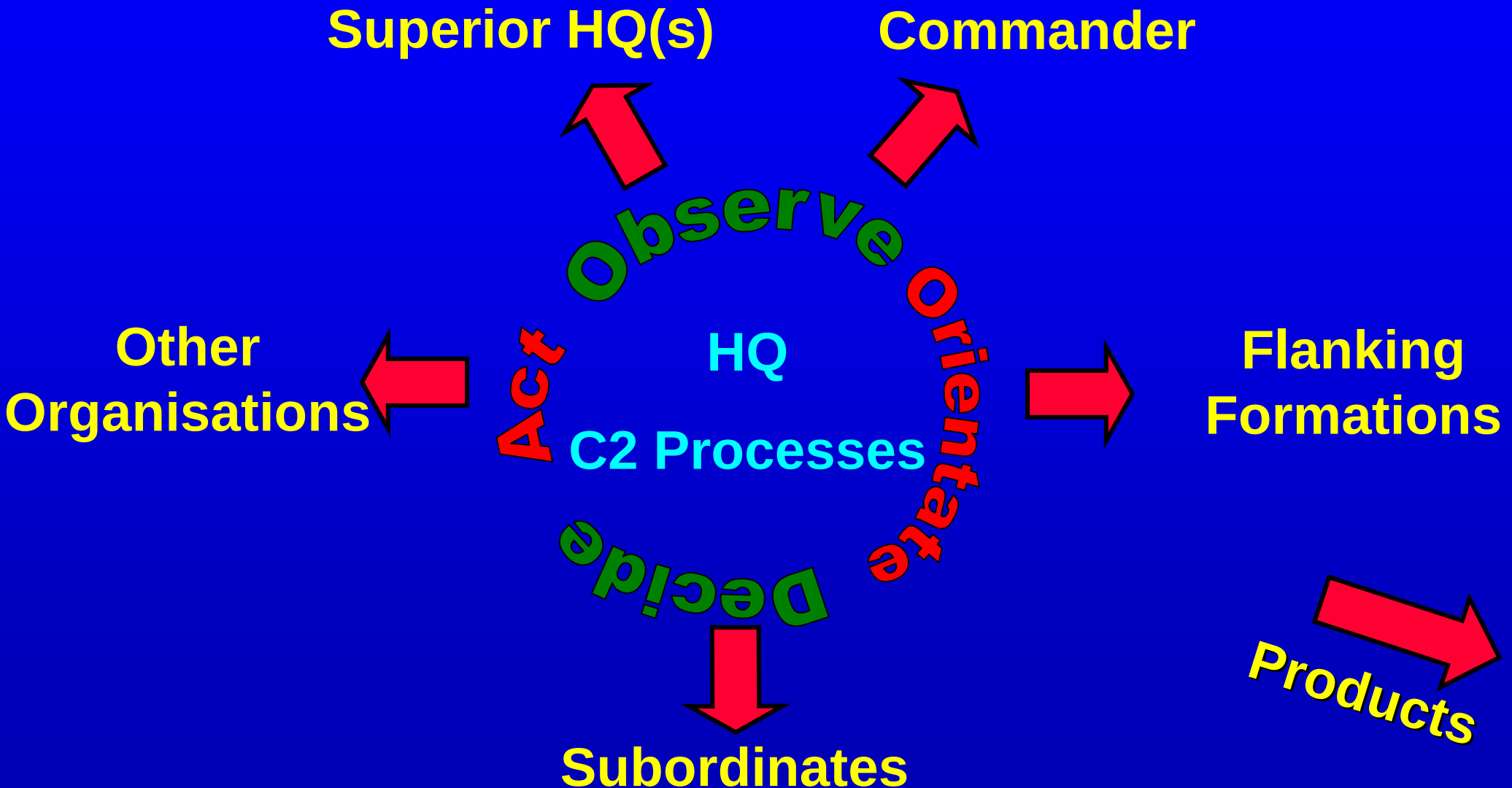
WARGAMES

SIMULATION

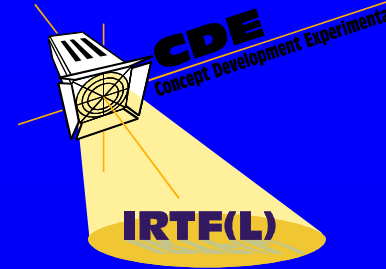
**HISTORICAL
ANALYSES**

**CONCLUSIONS
AND
RECOMMENDATIONS**

Measures of Merit

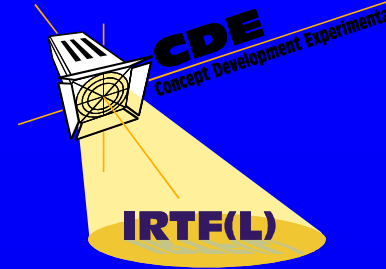


Measures of Merit



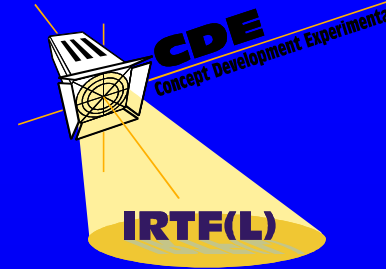
- **Product Assessment (MoCE)**
 - Timeliness
 - Quality
- **Viability & Sustainability (MoP)**
 - Principles of Command
 - Organisational Principles
 - Staff Workload
 - SOP Compliance
 - Coord between Comd Layers
 - Coord between Functions
 - Situational Awareness

Human & Organisational Issues



- **Span of command**
- **Leadership challenges**
- **Span of control**
- **Thinking at Two Levels**
- **New Organisational Structure**
- **New Procedures**
- **New Technology**
- **Increase in HQ Size**
- **Change to PE:CE Balance**

Scenarios

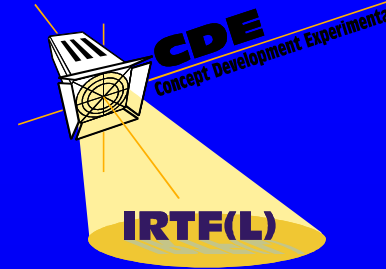


- **Exercises Exercises Exercises**
- **DRR**
- **Article 5 : Exercise Vignettes**
- **CRO : Falklands 1982**

Scenarios

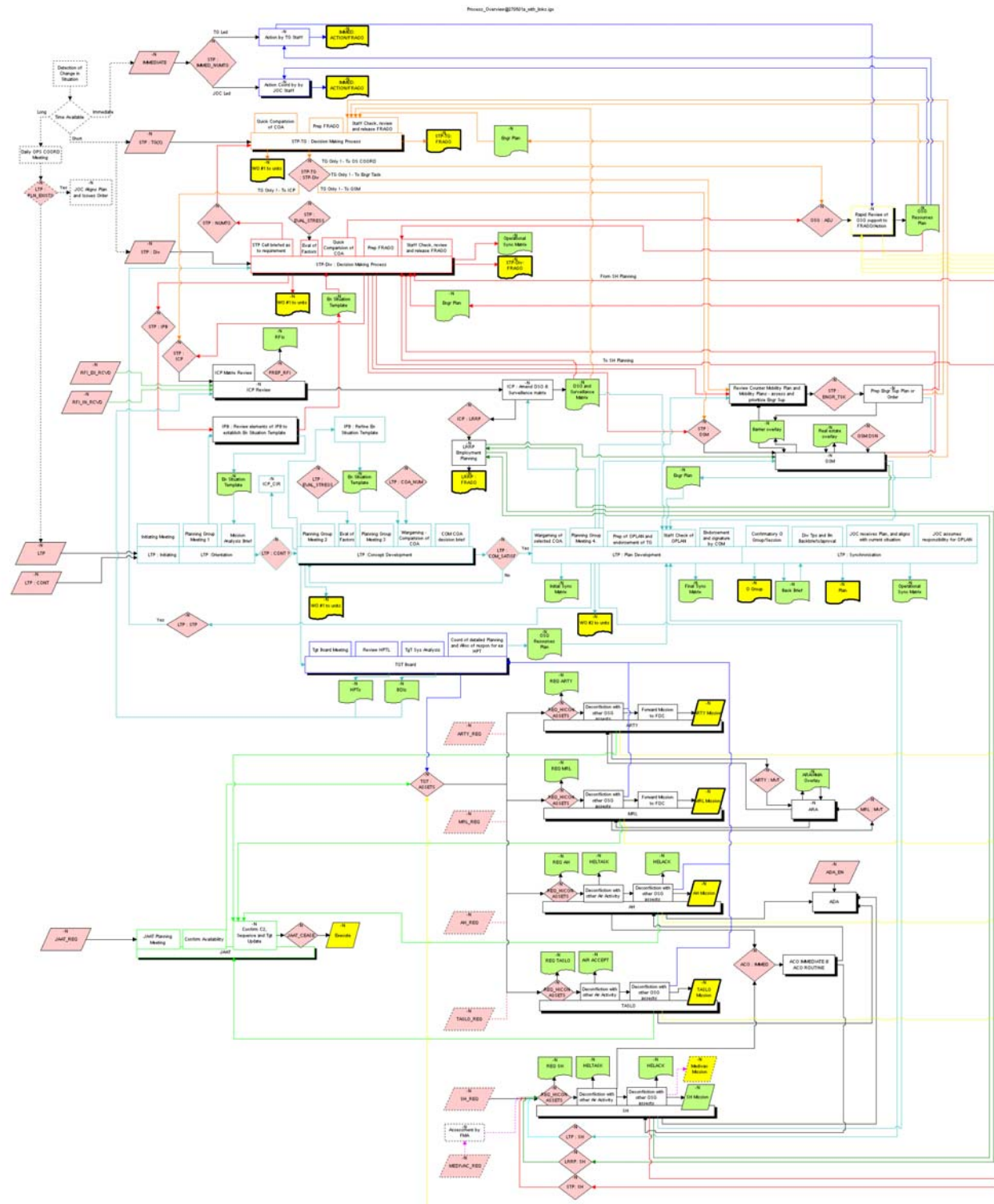
Tasks of a Typical Light Infantry Formation	Wargame 01 Main Defence I 3x TGs	Wargame 02 Main Defence II with restoration of NATO Territory 3x TGs	Wargame 03 Covering Force & Main Defence I 2x TGs	Beachhead and Goose Green. 21-30 May 1982 1x TG	Attack on Port Stanley 11-14 June 1982 2x TGs
Flank Protection	X		X	X	X
Key Point Defence	X		X	X	
Securing a Line of Departure	X	X	X		X
Main Defence	X		X		
Rear Area Security		X		X	X
Infiltration		X			X
Air Mobile Raids		X			
Deception Operations		X			
POW Cages		X		X	X
Security of Lines of Communication		X		X	X
Securing Key Terrain/River crossing	X	X		X	X
Reinforcement		X		X	X
Counter Penetration		X			
Urban Operations		X	X		
Infantry Assault/Attack				X	X

Tools



- **Data Collection**
 - ACCES
 - OCP
- **Process Analysis**
 - Spreadsheet
 - SIMUL8
 - Databases

A	B	C	D	E	F	G	H	I	J	
PROCESS : Intelligence Collection Plan Review SOURCE : Observations on CAX 2000, SOP 201, 208. ANALYTICAL INTERPRETATION : HQ Process WS II, HQ Process WS III DATE : 18 December 2000, 23 January 2001, 11 May 2001			Review of ICP can be triggered in three ways - on a daily basis as a result of the Targetting Board producing HPT and BDIs, on an as and when basis by the Targetting board (if new mission) and as a result of a new RFI from another HQ							A2-2
Description/Diagram	Routing	Notes	Location	Resources Req (Code)	Resources alternate (Code)	Approx Duration	Trigger (If Applicable)	Routing via Flag (If Applicable)	Data Source	Simulation Logic
<pre>graph TD; A([Mission Analysis Brief]) --> B[Review Mission Analysis for stated and implied CIRs]; B --> C([End]);</pre>	LTP - Main : Following Mission Analysis Brief	Mission analysis will trigger the TGT Board, which in turn will trigger the ICP review	-	-	-	-	-	-	-	<pre>graph TD; A([Mission Analysis Brief]) --> B[Review Mission Analysis for stated and implied CIRs]; B --> C([End]);</pre>
	No return req	-	J2	ACOS J2, CCIRM	J2 PLANS (Vice ACOS), J2 COORD (Vice CCIRM)	5-15 min?	-	-	-	
	From STP-TG - but only if STP-TG is triggered on own (as other wise covered by STP-Div)		-	-	-	-	-	-	-	
	From STP-Div									
<pre>graph TD; A([TGT board]) --> B{Triggered by LTP (via TGT Board)?}; B -- Yes --> C([To LTP: Wait until after PG4]); C --> D([From LTP: After PG4]); D --> E([STP-Div]); E --> F([STP-TG]); F --> G{ICP Review required?}; B -- No --> H([RFI from Flank and Superior]); H --> I([RFI from Enr]); I --> J[Coord with TG(X)G2]; J --> G; G -- Yes --> K[Review ICP: A. Review Extant PIRs and Indicators B. Add new RFI/BDIs etc to ICP C. Review Current tasking D. Match Sources and Agencies (SANDA)]; K --> L{Are there tasks that cannot be met by current divisionally controlled assets?}; L -- Yes --> F; L -- No --> G;</pre>	From TGT Process	List of BDIs and HPTs from TGT Board. Daily TGT Board also automatically Triggers daily review of ICP.	-	-	-	-	-	-	-	<pre>graph TD; A([TGT board]) --> B{Triggered by LTP (via TGT Board)?}; B -- Yes --> C([To LTP: Wait until after PG4]); C --> D([From LTP: After PG4]); D --> E([STP-Div]); E --> F([STP-TG]); F --> G{ICP Review required?}; B -- No --> H([RFI from Flank and Superior]); H --> I([RFI from Enr]); I --> J[Coord with TG(X)G2]; J --> G; G -- Yes --> K[Review ICP: A. Review Extant PIRs and Indicators B. Add new RFI/BDIs etc to ICP C. Review Current tasking D. Match Sources and Agencies (SANDA)]; K --> L{Are there tasks that cannot be met by current divisionally controlled assets?}; L -- Yes --> F; L -- No --> G;</pre>
	-		-	-	-	-	RFLEX_RCVD - RFI Received from Other HQs - or a report of an independent event which is of interest to IRTF(L) in a flanking formation Dist (day)		WG and logs	<pre>graph TD; A([TGT board]) --> B{Triggered by LTP (via TGT Board)?}; B -- Yes --> C([To LTP: Wait until after PG4]); C --> D([From LTP: After PG4]); D --> E([STP-Div]); E --> F([STP-TG]); F --> G{ICP Review required?}; B -- No --> H([RFI from Flank and Superior]); H --> I([RFI from Enr]); I --> J[Coord with TG(X)G2]; J --> G; G -- Yes --> K[Review ICP: A. Review Extant PIRs and Indicators B. Add new RFI/BDIs etc to ICP C. Review Current tasking D. Match Sources and Agencies (SANDA)]; K --> L{Are there tasks that cannot be met by current divisionally controlled assets?}; L -- Yes --> F; L -- No --> G;</pre>
							RFLIN_RCVD - RFI Received from Bns. Dist (day)		WG and logs	<pre>graph TD; A([TGT board]) --> B{Triggered by LTP (via TGT Board)?}; B -- Yes --> C([To LTP: Wait until after PG4]); C --> D([From LTP: After PG4]); D --> E([STP-Div]); E --> F([STP-TG]); F --> G{ICP Review required?}; B -- No --> H([RFI from Flank and Superior]); H --> I([RFI from Enr]); I --> J[Coord with TG(X)G2]; J --> G; G -- Yes --> K[Review ICP: A. Review Extant PIRs and Indicators B. Add new RFI/BDIs etc to ICP C. Review Current tasking D. Match Sources and Agencies (SANDA)]; K --> L{Are there tasks that cannot be met by current divisionally controlled assets?}; L -- Yes --> F; L -- No --> G;</pre>
		Bn RFI coord with TG(X) G2/CCIRM (SOP 206)		CCIRM, TG(X) G2		5-10min?				<pre>graph TD; A([TGT board]) --> B{Triggered by LTP (via TGT Board)?}; B -- Yes --> C([To LTP: Wait until after PG4]); C --> D([From LTP: After PG4]); D --> E([STP-Div]); E --> F([STP-TG]); F --> G{ICP Review required?}; B -- No --> H([RFI from Flank and Superior]); H --> I([RFI from Enr]); I --> J[Coord with TG(X)G2]; J --> G; G -- Yes --> K[Review ICP: A. Review Extant PIRs and Indicators B. Add new RFI/BDIs etc to ICP C. Review Current tasking D. Match Sources and Agencies (SANDA)]; K --> L{Are there tasks that cannot be met by current divisionally controlled assets?}; L -- Yes --> F; L -- No --> G;</pre>
		Data used for triggers RFLIN_RCVD and RFLIN_RCVD - RFI will be those RFI that will go through the system		CCIRM		1-5mins?				<pre>graph TD; A([TGT board]) --> B{Triggered by LTP (via TGT Board)?}; B -- Yes --> C([To LTP: Wait until after PG4]); C --> D([From LTP: After PG4]); D --> E([STP-Div]); E --> F([STP-TG]); F --> G{ICP Review required?}; B -- No --> H([RFI from Flank and Superior]); H --> I([RFI from Enr]); I --> J[Coord with TG(X)G2]; J --> G; G -- Yes --> K[Review ICP: A. Review Extant PIRs and Indicators B. Add new RFI/BDIs etc to ICP C. Review Current tasking D. Match Sources and Agencies (SANDA)]; K --> L{Are there tasks that cannot be met by current divisionally controlled assets?}; L -- Yes --> F; L -- No --> G;</pre>
	-	ICP is a matrix controlled by the CCIRM. It is of PIRs and Indicators listed against SANDA.	J2	CCIRM	J2 COORD (Vice CCIRM)	10 - 30 min	-	-	-	<pre>graph TD; A([TGT board]) --> B{Triggered by LTP (via TGT Board)?}; B -- Yes --> C([To LTP: Wait until after PG4]); C --> D([From LTP: After PG4]); D --> E([STP-Div]); E --> F([STP-TG]); F --> G{ICP Review required?}; B -- No --> H([RFI from Flank and Superior]); H --> I([RFI from Enr]); I --> J[Coord with TG(X)G2]; J --> G; G -- Yes --> K[Review ICP: A. Review Extant PIRs and Indicators B. Add new RFI/BDIs etc to ICP C. Review Current tasking D. Match Sources and Agencies (SANDA)]; K --> L{Are there tasks that cannot be met by current divisionally controlled assets?}; L -- Yes --> F; L -- No --> G;</pre>
		(RFIs are also indicated/enabled to the ICP)	-	-	-	-	-	-	WG	<pre>graph TD; A([TGT board]) --> B{Triggered by LTP (via TGT Board)?}; B -- Yes --> C([To LTP: Wait until after PG4]); C --> D([From LTP: After PG4]); D --> E([STP-Div]); E --> F([STP-TG]); F --> G{ICP Review required?}; B -- No --> H([RFI from Flank and Superior]); H --> I([RFI from Enr]); I --> J[Coord with TG(X)G2]; J --> G; G -- Yes --> K[Review ICP: A. Review Extant PIRs and Indicators B. Add new RFI/BDIs etc to ICP C. Review Current tasking D. Match Sources and Agencies (SANDA)]; K --> L{Are there tasks that cannot be met by current divisionally controlled assets?}; L -- Yes --> F; L -- No --> G;</pre>
							PREP_RFI - Requests for Information (RFIs) needing to be Prep Prob (% of cases) Prob (Num per Case) : upto 5 (IE left flank,			<pre>graph TD; A([TGT board]) --> B{Triggered by LTP (via TGT Board)?}; B -- Yes --> C([To LTP: Wait until after PG4]); C --> D([From LTP: After PG4]); D --> E([STP-Div]); E --> F([STP-TG]); F --> G{ICP Review required?}; B -- No --> H([RFI from Flank and Superior]); H --> I([RFI from Enr]); I --> J[Coord with TG(X)G2]; J --> G; G -- Yes --> K[Review ICP: A. Review Extant PIRs and Indicators B. Add new RFI/BDIs etc to ICP C. Review Current tasking D. Match Sources and Agencies (SANDA)]; K --> L{Are there tasks that cannot be met by current divisionally controlled assets?}; L -- Yes --> F; L -- No --> G;</pre>





Speed:

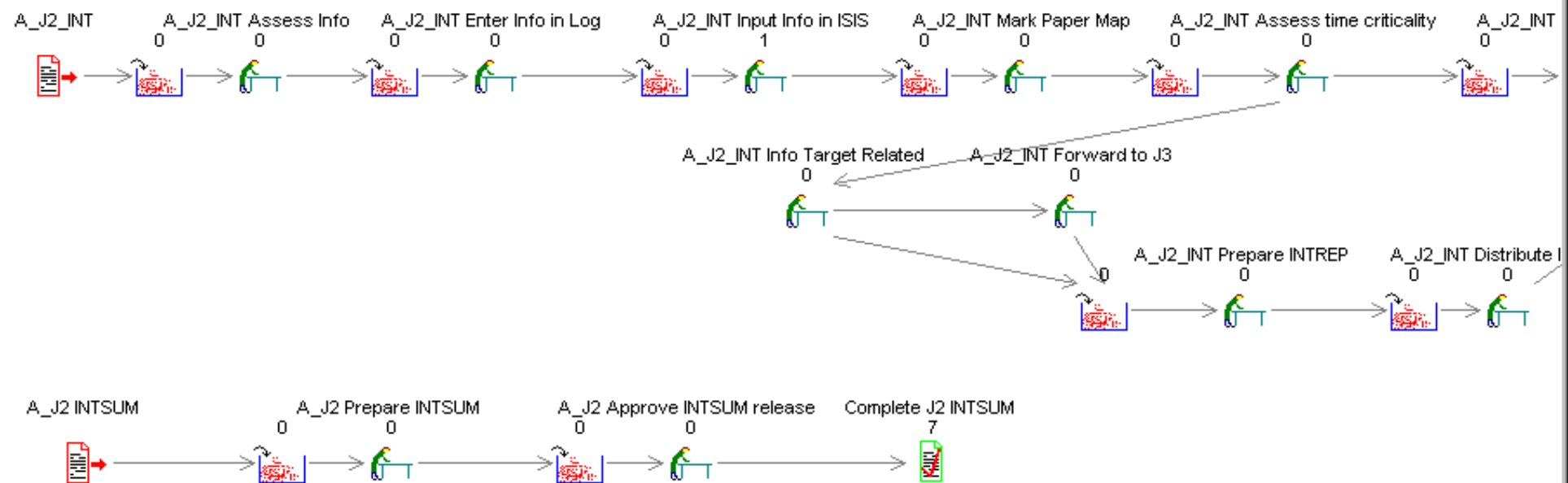
Clock

0:00

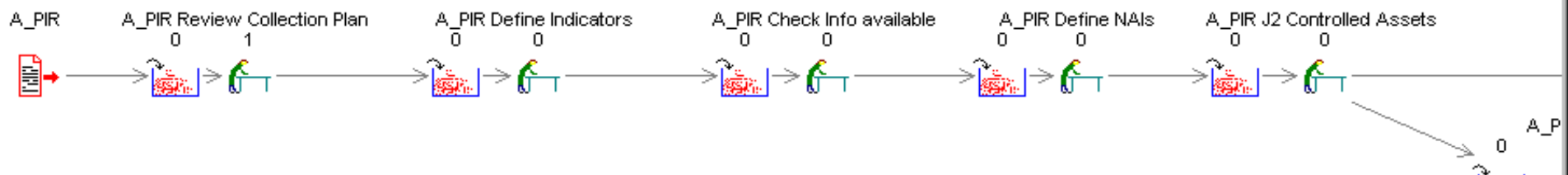
Mon

SIMUL8 Sub-Window: J2

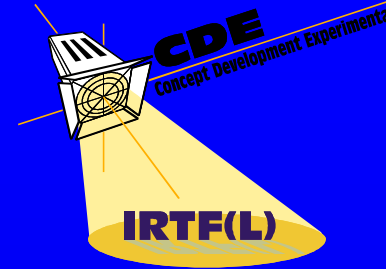
J2 INT INFO PROCESSING (INTSUM)



J2 PIR



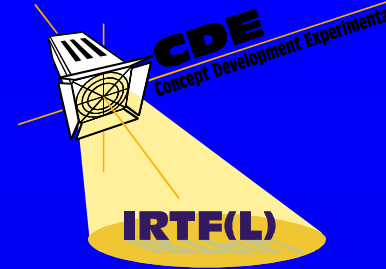
Tools



- **Data Collection**
 - ACCES
 - OCP
- **Process Analysis**
 - Spreadsheet
 - SIMUL8
 - Databases
- **Wargame**
 - Manual

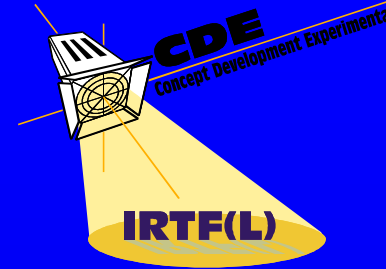


Data



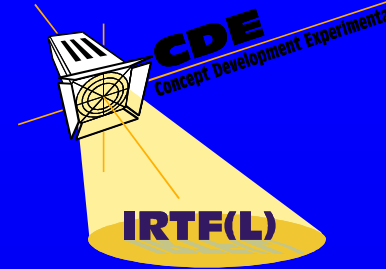
- **Exercises**
 - Limitations
 - Complex but Holistic
- **Subject Matter Experts**
 - Observers
 - HQ Staff
 - Analysts
 - Wargame
 - Military
 - Historical
- **Consultants**

Risk & Uncertainty



- **Solution Strategy**
 - Incomplete mission coverage
 - C2 sub-concept only
 - Exercise-centric
 - 2x TG
 - Evolving concept
 - Missing functional areas
- **Communication of Risk**

Products

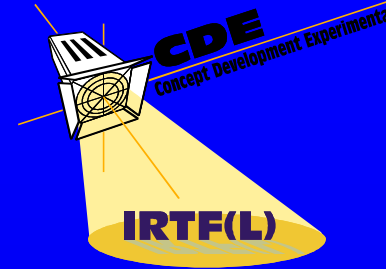


- **White Paper**
- **Experimentation Plan**
- **Exercise Reports**
- **Final Report**
- **Method Reports**

- **Peer Review**

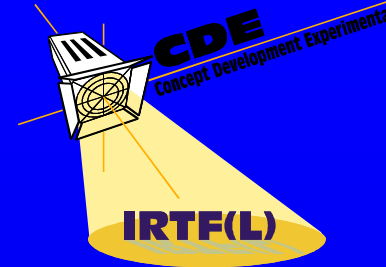
Conclusions :

IRTF(L)



- **No Fundamental Flaws in C2 Concept**
- **Assessed for Infantry Div Only**
- **Key problem Area : proportion of CE**
- **Could be made to work**

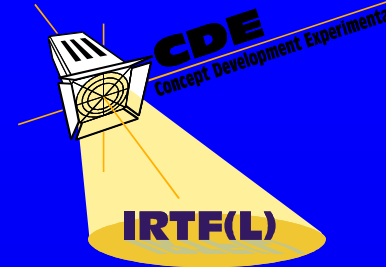
Conclusions : COBP



- **Utility**
 - Assisted holistic assessment
 - Continual Problem Formulation
 - Awareness of weakness of Solution Strategy
- **Our Lessons**
 - Reject preconceived methods
 - Question arbitrary deadlines
- **Never Again...** (don't expt on an operational HQ)
- **What we would have done.....if....**



QUESTIONS?



MATE NĚJAKÉ OTÁZKY ??

DO YOU HAVE ANY QUESTIONS...?

AVEZ VOUS DES QUESTIONS ?

HABEN SIE NOCH FRAGEN ?

ALGUNA PREGUNTA...?

SPØRGSMÅL ??

A VOSTRA DISPOSITIONE PER EVENTUALI DOMANDE

TEM ALGUMA QUESTÃO PŌR ??

HAR DERE NOEN SPØRSMÅL ??