A Report by NATO's
Joint Analysis and Lessons Learned Centre

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Information Flow and Command and Control in a Joint Headquarters

as observed in Exercise STEADFAST JUNCTURE 10

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FOREWORD FROM THE COMMANDER

I am pleased to forward this report on the analysis of information flow and Command & Control (C2) in the context of the Peacetime Establishment (PE) and Deployable Joint Staff Element (DJSE) structures, as observed in the Steadfast Juncture 2010 exercise.

The report examines the information flow within a split, joint headquarters (JHQ). The analysis is not limited to the formal Information Management (IM) and Reports & Returns procedures. Informal information exchanges that occur outside of the control capabilities of the IM and Reports & Returns regimes have also been analysed.

The report contains a number of findings and recommendations. I would like to draw your attention to two of them.

The information flow through a JHQ is currently not well understood. A significant contributing factor is that information flows through multiple complex systems, which, while operating independently, are interrelated. To understand the JHQ's overall flow of information, these systems must be considered together as one "System of Systems." Using this approach is an excellent way to obtain a fuller understanding of the intricate paths by which the ever-increasing amount of information flows through an HQ.

The analysis of C2 determined that there are few issues in the structures introduced by the new JFC Peacetime Establishment and the DJSE concept that are contradictory to NATO's Command and Control Principles as defined in AJP-3(A) *Allied Doctrine for Joint Operations*.

I am particularly encouraged by the fact that JFC Brunssum used the lessons identified from the analysis of previous exercises to mitigate the possible undesirable consequences resulting from a change in the Commander and therefore these lessons appear to have been truly learned.

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Information Flow and Command & Control in a Joint Headquarters

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Executive Summary

MISSION

The deployable and expeditionary capabilities of Allied Command Operations (ACO) are challenged by the new Peacetime Establishment (PE) for NATO's Joint Force Commands (JFC) and the implementation of the Deployable Joint Staff Element concept. These changes may result in unforeseen consequences for Command and Control (C2) and information flow between the two parts of the Joint Headquarters (JHQ)—the MAIN and the Forward Element (FE)—and with subordinate commands. Such challenges have been largely un-examined. Therefore, the Joint Analysis and Lessons Learned Centre (JALLC) was tasked in its 2010 Programme of Work with the following Analysis Requirement.

Analysis Requirement: Provide SHAPE, the JFCs, and the Component Commands (CC) with an understanding of C2 and Information Flow issues between the distributed staff elements (MAIN and FE) as well as between the HQ and subordinate components in order to inform further development of the JFC structure and the Deployable Joint Staff Element concept.

The agreed analysis objectives were:

AO-1. Identify and explain C2 and Information Flow issues within the distributed staff elements (MAIN and FE) as well as among the HQ and subordinate components involved in STEADFAST JUNCTURE (SFJE) 10. Focus on answering:

Sub AO-1.1. Were C2 and Information Flow consistent with the principles of C2 and Information Management (IM) described in NATO policies? If not, why not?

Sub AO-1.2. How did C2 issues affect Information Flow and vice versa?

AO-2. Explain how specific issues of concern to JFC Brunssum impacted the C2 and Information Flow within the distributed staff elements (MAIN and FE) as well as among the HQ and subordinate components involved in SFJE 10. The specific issue is:

Sub AO-2.1. What was the impact of the nomination of a FE Deputy Commander (DCOM) on C2 and Information Flow?

METHODOLOGY

The data supporting this analysis was collected through detailed reviews of Standing Operating Procedures (SOP), Standing Operating Instructions (SOI), NATO Policies, Directives and other materials; and via observation and interviews at the SFJE 10 planning[1] and execution[2] events in 2010. Interviews were carried out with 90 individuals, including the Commander, the key staff in the JHQ, and a number of CC key commanders and staff. Data was analysed at the JALLC thereafter.

Categories of information

The information flowing through the JHQ falls into three broad categories:

[1] Crisis Response Planning Phase II B in February 2010; Battle Staff Training Phase I D.

[2] Execution Phase III B in May 2010 (MAIN in JFC Brunssum, Forward Element in Valdahon, France).

a. Formal IM: Official Correspondence; Command Group generated tasking and Direction & Guidance which flows primarily through MAIN Business and Information Management (BIM) to FE Director of Staff (DOS) channels (BIM–DOS).

b. Operational Reports & Returns: The daily, weekly and event driven reporting regime which flows into the JHQ predominantly via the Situation Centre and Situation Cell; and out of the JHQ to SHAPE.

c. Informal Information Exchanges & Mechanisms (IIE/M): Other exchanges which take place within the JHQ which are neither captured nor visible via the IM and Reports & Returns mechanisms.

CONCLUSIONS

General

The overall flow of information through the JHQ is a system of three systems: Reports & Returns, formal Information Management, and informal information exchanges, all of which exhibit certain characteristics of complex systems.

The information flow system of systems is neither clearly documented nor understood. As such, it is currently not feasible to determine whether the individual systems, as parts of the overall system, are optimally designed to support the management of the JHQ's overall information flow.

The complexity of the processes and difficulties in tracking and managing the information, even within the formal information management system, may impact both the COM's ability to exercise effective C2 and the efficiency of the JHQ.

The lack of detail in the relevant JHQ SOP for IM has resulted in each JFC developing its own IM SOIs, creating challenges when a JHQ is formed by integrating an FE—for which the two NATO FCs provide the majority of the staff—with a MAIN staff from one of three JFCs.

Relating to Analysis Objective 1

Sub-Analysis Objective 1.1

Information is exchanged within the JHQ via mechanisms which are outside the official "Information Management" and "Report & Returns Regime" processes. These informal information exchanges are unavoidable, part of the life of a HQ, and occur in a variety of ways, including phone, face-to-face, JCHAT, email, OCS, etc. There are no official mechanisms in place to capture, track or manage these exchanges which render it nearly invisible and, in many cases, transient data. In terms of NATO's Principles of Information Management, they appear to be a potential vulnerability.

Direction, guidance and tasking from the COM which was not captured and disseminated within the formal IM mechanisms (as required by the SOPs/SOIs) resulted in highly significant information being dispensed via informal channels rather than through the formal IM system; this degraded the efficiency of the JHQ staff and may have compromised the COM's ability to exercise effective C2.

Sub-Analysis Objective 1.2

The number of regularly scheduled daily/weekly reports flowing through the JHQ has the potential to utilize a significant amount of the JHQ's Reports & Returns system capacity, but further investigation is required into this issue before firm conclusions can be drawn. Event-driven Reports & Returns, which are initiated and driven by in-theatre incidents, represent an additional load on the system. Overloading the JFC's Reports & Returns capacity will result in degradation of the JHQ's situation awareness.

Relating to Analysis Objective 2

Sub-Analysis Objective 2.1

The chain of command, as put in place during SFJE 10, was clearly understood at all levels and the delegation of command (from COM to DCOM) during the exercise had no discernible impact on the exercising of effective C2. The actions adopted by JFC Brunssum for SFJE 10 to mitigate possible undesirable consequences resulting from a change in the Commander were effective: these included taking note of lessons identified during previous exercises and the deployment of the Chief JOPG as part of the COM's special staff in the FE.

Sub-Analysis Objective 2.2

Multiple operations for a JFC may require some JHQ MAIN staff to divide their time and attention between operations. As a result, the MAIN staff may be less accessible and responsive to the staff of the JHQ FE and the CCs who remain focussed on a single operation.

RECOMMENDATIONS

Overall Information Flow

Analyse the entire flow of information through the JHQ in the context of a system of systems comprising of formal IM, Reports & Returns, and IIE/M processes, procedures and mechanisms, with the goals of:

a. Developing a unifying lexicon that bridges all of the individual systems.

b. Developing an overall architecture that provides for formal information capture and management without compromising the flexibility provided by informal information exchanges.

IM Architecture

Analyse the overall IM architecture with respect to the particular requirements arising out of the split MAIN–FE JHQ; and from the understanding gained:

a. Ensure that future IM architectures are designed to simplify the information flow and reduce the nesting of procedures within other procedures.

b. Develop a JHQ IM SOP with sufficient detail to discourage heavy reliance on non-standardized SOIs.

Reports & Returns

Carry out a judicious review of all Reports & Returns to meet the information requirements of both the JHQ and higher command, to ensure that the Reports & Returns regime:

a. Meets the minimum requirement, with additional Reports & Returns requiring justification for inclusion.

b. Is in compliance with the NATO Principles of Information Management concerning information needs of the JHQ staff.

c. As far as possible, distributes the Reports & Returns workload across the JHQ staff.

Promulgate a standard Reports & Returns regime matrix in the JHQ SOP.

Informal Information

Conduct further analysis to identify the full nature of the informal information exchanges within the JHQ that are neither captured nor visible via the official IM and Reports & Returns processes, with the following aims:

a. Determine the nature of the information exchanged, among whom it is exchanged, the channels and mechanisms that are employed, and whether its visibility across the JHQ is desirable.

b. Determine if existing IM and Reports & Returns mechanisms and procedures could be leveraged or modified to capture the informal exchanges, or if additional mechanisms/procedures need to be developed.

Maintaining continuity of command

Continue to include the Chief JOPG as part of the COM's Special Staff to maintain continuity between the planning and execution.

Distribution

Action:

SHAPE

HQ SACT

Information:

JFC Brunssum

JFC Naples

JFC Lisbon

FC Madrid

FC Heidelberg

CC-Air Izmir

FRMARFOR

JWC

JFTC

SHAPE FOR RER

HQ SACT Deployable Forces IPT

OPD

SHAPE FOR RER FSL

SHAPE FOR RER FSL Lessons Learned

SACTREPEUR

HQ SACT DCOS SPP

HQ SACT ACOS CAP REQ

HQ SACT CAPDEV PPM LLI

National Military Representatives to SACEUR

National Liaison Representatives to SACT

NSO

C2COE

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1 Introduction

BACKGROUND

1. This report presents the Joint Analysis and Lessons Learned Centre's (JALLC) analysis of Information Flow and Command and Control (C2) exercised in the operational level HQ structures employed at Exercise STEADFAST JUNCTURE (SFJE) 10. Although the main venues from which data was actively collected were the SFJE 10 Battle Staff Training and the Phase III Execution phases, this report does not contain an analysis of SFJE 10; it is the latest in a series of JALLC analyses that have been conducted as part of a longer term effort to advance the development of NATO's deployable forces concepts.

2. The following excerpt from the JALLC 2010 Programme of Work (Reference A) provides additional context underlying the original request for analysis and the final wording of the Analysis Requirement and Objectives:

> *The **[Joint Force Command] JFC structure** within NATO **is currently undergoing transformation** due to a revised Interim Special[sic] Peacetime Establishment and the implementation of the Deployable Joint Staff Element (DJSE) concept. The **implication of these changes** on the **overall Command and Control** and **Information Flow** has been largely **un-examined**. It is assumed that full implementation of the changes will result in **unforeseen C2 and Information Flow challenges** among the 2 distributed portions of the HQ (MAIN and DJSE) as well as with subordinate commands.*
>
> (***bold*** emphasis added)

ANALYSIS REQUIREMENT AND ANALYSIS OBJECTIVES

Analysis Requirement: Provide SHAPE (and in doing so also provide the JFCs and Component Commands (CC)) with an understanding of C2 and Information Flow issues between the distributed staff elements (MAIN and Forward Element (FE)) as well as between the HQ and subordinate components in order to inform further development of the JFC structure and the DJSE concept.

AO-1. Identify and explain C2 and Information Flow issues within the distributed staff elements (MAIN and FE) as well as among the HQ and subordinate components involved in SFJE 10. Focus on answering:

Sub AO-1.1. Were C2 and Information Flow consistent with the principles of C2 and Information Management (IM) described in NATO policies? If not, why not?

Sub AO-1.2. How did C2 issues affect Information Flow and vice versa?

AO-2. Explain how specific issues of concern to JFC Brunssum impacted the C2 and Information Flow within the distributed staff elements (MAIN and FE) as well as among the HQ and subordinate components involved in SFJE 10. The specific issues are:

Sub AO-2.1. What was the impact of the nomination of a Forward Element (FE) Deputy Commander (DCOM) on C2 and Information Flow?

Sub AO-2.2. What was the impact of the JFC running multiple missions on C2 and Information Flow?

PURPOSE OF THE REPORT

3. This analysis was conducted with the following goals:

a. Identify and provide insights and recommendations in support of the efforts of the two Strategic Commands on NATO's deployable forces concepts, including standardization of NATO-wide deployable force doctrine, concepts procedures and policies.

b. Identify operational level lessons and recommendations for the NATO JFCs and Force Commands (FC) that will enhance the understanding and implementation of NATO Response Force (NRF) and concepts for the operational level HQ.

Other Outputs

4. In addition to this report, the findings documented herein together with the lessons, insights, best practices and challenges derived from previous JALLC analyses of NRF/DJSE events were disseminated to the JFC and FC staff via best practice briefings.

5. The JALLC has also provided rapid feedback of critical issues that may require more immediate attention through submissions to the exercise First Impression Report, Final Exercise Report, direct exchanges, and interim briefings with JFC and FC staff.

METHODOLOGY

6. The data supporting this analysis was collected through detailed reviews of Standard Operating Procedures (SOP), Standard Operating Instructions (SOI), NATO Policies, Directives and other materials, and via observation and interviews at the exercise events.

7. Initial data was collected at SFJE 10 Crisis Response Planning Phase IIB (February 2010) and SFJE 10 Battle Staff Training Phase ID (March 2010, JFC Brunssum and FC Madrid. The main active data collection effort took place in SFJE 10 Execution Phase IIB (May 2010) during which the JALLC deployed two five-person teams. One team was deployed to the MAIN in JFC Brunssum and the other to the Forward Element (FE) in Valdahon, France.

8. The data set consisted of approximately 90 different interviews or specifically observed and recorded events. Interviews were conducted with JFC Commander (COM), JFC Deputy Commander (DCOM), JFC Chief of Staff (COS), FE COS, Air Component Coordination Element (ACCE) Director, COM Land Component Command (LCC), COM Joint Logistics Support Group (JLSG) and the directors and heads of most of the MAIN and FE Branches, Centres and Cells. The analysis of the data took place at the JALLC in Monsanto, Portugal from June through early October 2010.

9. Analysis involved decomposition and compilation of the interviews, observations and the Standing Operating Instructions (SOI), SOP, Policy, etc. The JALLC approached the analysis by examining patterns within three distinct types of information flow. As a final step, the data was examined and described in the context of the literature on complex systems, since it had become apparent that Information Flow constitutes a complex system of systems.

10. Initial and interim impressions and findings were disseminated to the relevant participants of the SFJE 10 training audience for review and feedback. All relevant input has been incorporated into the report.

FACTORS AFFECTING THE ANALYSIS

11. The exercise was not planned for 24/7 activities. It was therefore not possible to assess exactly the limits of the work overload.

12. In addition to participation in SFJE 10, the JFC providing the Joint HQ (JHQ) also had tasks associated with the real world mission of the International Security Assistance Force.

OTHER FACTORS OBSERVED

13. Although not a focus of the SFJE 10 analysis, it was evident that the JFC and the FC did not have adequate opportunities in advance of the exercise to:

a. Develop many of the relationships and understandings of roles and functions required to achieve the functionality of a single seamless JHQ in advance of the exercise.

b. Become trained and familiar with the use of many of the tools and functional services they would employ as part of the JHQ.

14. These are persistent lessons that were previously identified during SFJE 09.

2
JHQ Information Flow: One System of Multiple Systems?

*"A **complex system** is one in which there are multiple interactions between many different components."* D. Rind (1999) [3]

*"**Systems of systems** are large-scale concurrent and distributed systems, the components of which are complex systems themselves."* V. Kotov (1997) [4]

15. Information Flow is generally viewed as a critical issue in the organization of modern military HQs. During this analysis, the JALLC found that it was nearly impossible to capture the full extent of the dynamic information flow through the JHQ—comprised of the MAIN and FE—by attempting to view it as a single system. The JALLC believes that the best way to understand the actual complexity of the Information Flow in a modern military HQ is to consider it to be multiple, interrelated systems that are each part of the JHQ's System of Information Systems (Figure 1). This concept may prove useful to the HQ's Information Managers.

16. The following three "complex systems" were identified:

a. **Formal Information Management (IM):** This system reflects information that is "captured" by the IM procedures, processes and mechanisms that are in place to track "official information" such as Official Correspondence, Command Group generated tasking, and COM Direction & Guidance. It also encompasses the information flow resulting from in-theatre events that are deemed significant enough to merit Command Group level tasking. The MAIN Business and Information Management (BIM) to FE Director of Staff (DOS) channel (BIM–DOS) is the primary conduit through which this information flows.

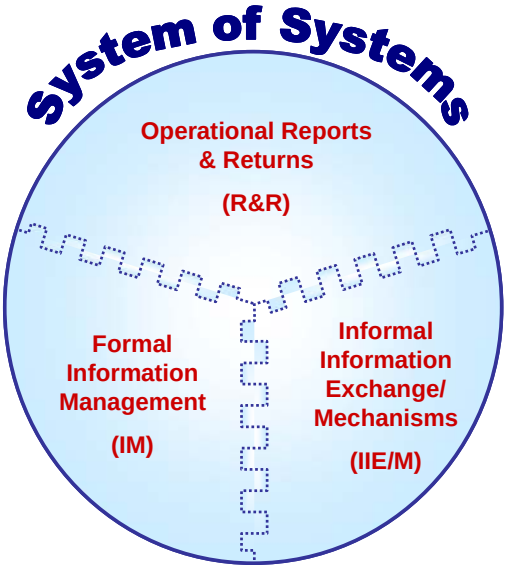

Figure 1: System of Information Systems

b. **Operational Reports & Returns:** This system reflects the information that is contained in the daily, weekly, and event-driven reports as delineated by the JFC's Operational Reporting Regime. These reports and returns flow from in-theatre into the JHQ via the Situation Centre (SITCEN) and Situation Cell (SITCELL) and onward to Offices of Primary Responsibility (OPR) for handling.

c. **Informal Information Exchange/Mechanisms (IIE/M).** This is not one of the "traditional" JHQ information systems, but rather one that was identified during the course of these analyses. In this system, information is exchanged that falls outside

[3] Definition from: Science Vol. 284 No. 5411 (1999); a special edition on complex systems.

[4] Definition from: Kotov, V. "Systems-of-Systems as Communicating Structures," Hewlett Packard Computer Systems Laboratory Paper HPL-970124, (1997), pp. 1-15.

the control mechanisms that the IM and Reports & Returns processes establish. As such, most of the IIE/M exchanges are not captured by or visible to either the IM or Reports & Returns systems. During this analysis, the JALLC found that a significant amount of the information that is exchanged within the JHQ falls within this system, and that because the very nature of this information exchange is informal, little guidance and few mechanisms were identified that provide for its management.

17. Figure 1 intentionally includes serrated lines to emphasize that the individual "systems" are interrelated and interdependent. That is, IM, Reports & Returns, and IIE/M are complex systems that make up the JHQ's System of Information Systems. The main findings for each of these "systems" are presented individually in the next chapter, followed by a discussion of the interrelationships among them.

18. A more dynamic representation of the three systems is provided in Figure 2 in which the IM system is represented on the left centre (teal text and arrows), the Reports & Returns toward the right centre (green text and arrows) and the IIE/M captured by the black arrows that are scattered throughout the diagram.

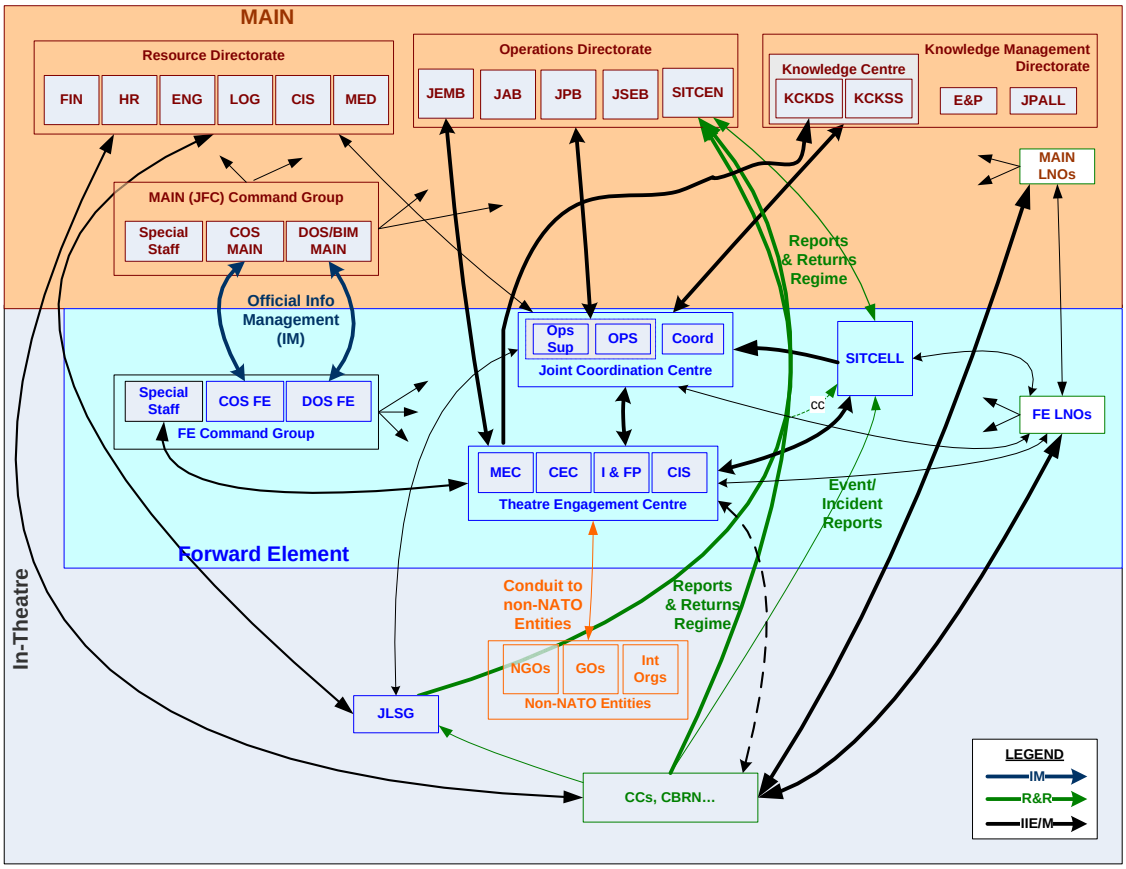

Figure 2: Dynamic Representation of IM, Reports & Returns and IIE/M

3
Information Flow Systems

FORMAL INFORMATION MANAGEMENT – DEALING WITH INTERRELATED PROCEDURES

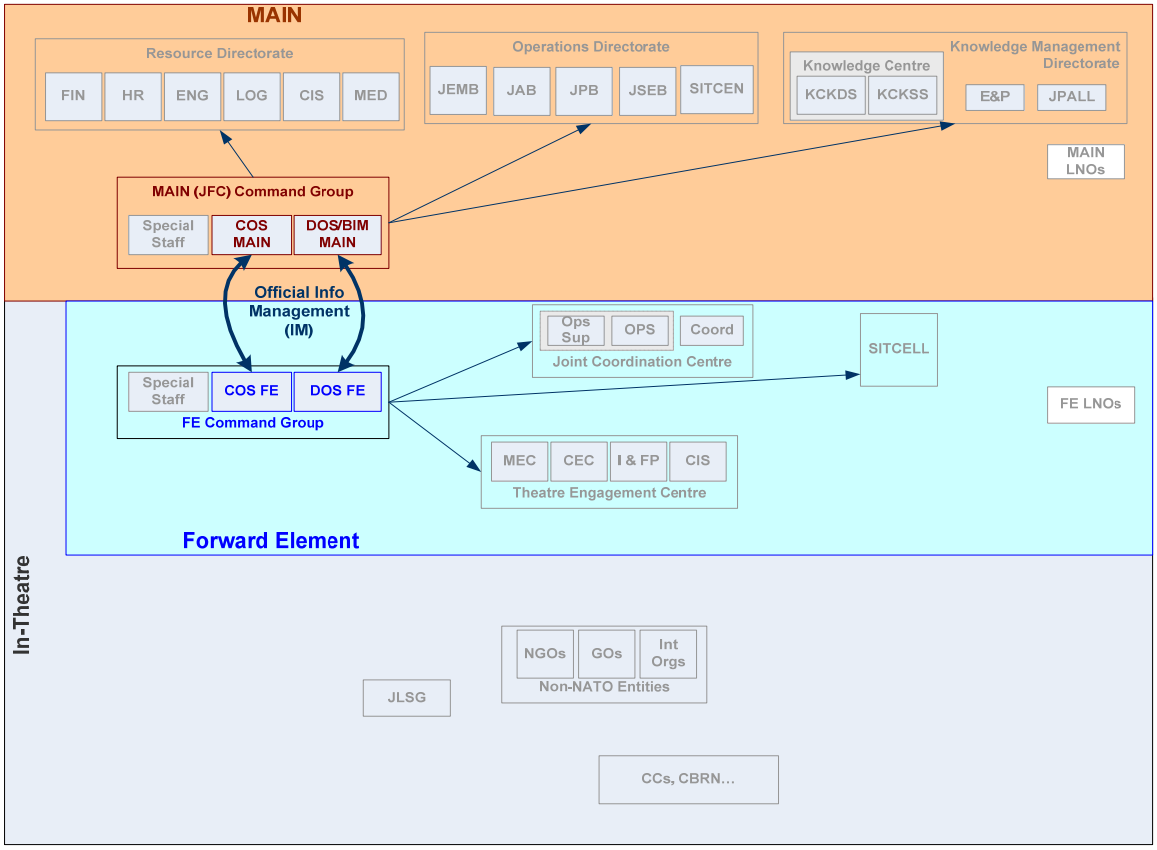

Figure 3: Formal Information Management

Key Findings

19. The JHQ's IM processes and procedures exhibit the characteristics of a complex information system.

20. The formal IM processes, procedures and mechanisms are extremely complex, interwoven and nested, obscuring the JHQ's overall ability to track information through the JHQ, with a resulting degradation in situation awareness. Although the consequences of this degradation are not quantified in this analysis, a task which remain for follow-on studies, the complexity of the processes and difficulties in tracking and managing the information may impact both the COM's ability to exercise effective C2 and the efficiency of the JHQ.

21. Because of the lack of detail in the JHQ SOP for IM, JFC specific, non-standardized IM SOIs are being developed, forcing each FE—for which the majority of the staff are provided by one of the DJSEs within the two NATO FC Peacetime Establishments—to readapt when it is paired with a different JFC.

Information: a BIM–DOS Responsibility or a Corporate Resource?

22. Most of the formal Information Management within the JHQ falls under the auspices of the BIM in the MAIN and the DOS in the FE (see Figure 3). According to Reference B, the DOS, when the FE is activated, is responsible for, among other things *"Management Planning, HQ Information Management, Staff Coordination, …".* Reference B also states for the FE DOS that "*key to this is the need to support the flow of key information in, through, and out of the HQ*[5] *in support of the Command Group, HQ Battle Rhythm, Daily Routine, calendar of events, archive and operational record*".

23. A requirement for supporting the "flow of key information…" is that official taskers be captured and tracked from their onset through their completion. Command Group tasking originates from four specific venues:

a. Battle Rhythm meetings,

b. Command Group Direction & Guidance,

c. Official Correspondence, and

d. In-theatre Events.

24. The flow of these taskers (i.e. the paths they follow as they are processed by the JHQ staff) varies, depending on a variety of factors including (among other things): the origin; the OPR; where approval and release authority lays, etc. The end result is that the actual path taken by *"the flow of key information in, through and out of the HQ"* is context dependent.

25. It is not realistic to expect BIM and DOS to manage information that is either not captured or is hidden as a result of:

a. System design flaws (i.e. inadequate SOP/SOI).

b. Complex routing masking and/or reduced visibility of information paths.

c. System saturation/overload due to high information volume that hides or obscures critical information.

d. Inadequacies in, or lack of access to, the tools/mechanisms upon which IM relies.

e. Lack of adequate familiarization/training with IM processes and/or the tools which may lead to unrealistic expectations of their capabilities.

26. The complete range of factors that must be addressed in order to truly manage the JHQ's information extends well outside the capabilities of the BIM–DOS. Recognition of this reality is one of the factors behind NATO establishing, as a central Principle of IM, that information must be treated as a "Corporate Resource", implying that the responsibility for information (and its management) does not fall solely on the BIM–DOS. The JALLC observed during SFJE 10 that there appeared to be adherence among the IM, Command Groups and Key Staff communities to this principle of information being a Corporate Resource; however it did not appear to be fully embraced or understood by all the JHQ staff outside of these groups.

IM constitutes a Complex System

27. The following factors support the conclusion that the JHQ IM is a complex system:

a. The volume of material required to describe all the facets of IM of the DJSE concept—27 different SOPs, SOIs, Directives, Policies, and other documents have

[5] Note that Reference B was updated post-SFJE 10 in August 2010 and 'HQ' has been replaced by 'FE' in the new version.

been identified and understanding the IM procedures and flow in their entirety requires knowledge and integration of the information contained in all these materials.

b. The interrelated and/or nested nature of many of the IM SOPs and SOIs. For example, many of the diagrams in the various annexes contain "place holder" boxes that actually represent additional levels of tasks and actions that are described in an entirely different SOI.

IM is a key to effective C2?

28. One important aspect of IM is that the processes and procedures it establishes support the JHQ in maintaining positive control of the management and tracking of Command Group decisions and staff activities. An essential element of this, in support of the COM's efforts to exercise effective C2, is that the information, decisions, and taskings be visible across the JHQ and efficiently disseminated to subordinate entities.

29. One method of attaining the level of visibility required to permit management of the JHQ's information is to establish "Planned Control Capabilities" (PCC). As there is no agreed NATO definition for PCCs, the following definition of PCC, taken from the JALLC analysis of STEADFAST JAW 2007, will be used:

> *Mechanisms, persons, procedures, systems, etc. that are established to enhance a commander's ability to assume and maintain command and control over arriving units (whether temporarily or permanently). These can range from Computer and Information Systems, medical command structures, liaisons, products (Joint Coordination Orders, etc.) or any other type of mechanism that will aid the commanders in assuming the planned C2.*

30. During SFJE 10, the IM system did contribute positively to the situation awareness of the JHQ through the various established PCCs that enabled the JHQ and COM to track taskers resulting from Official Correspondence, Command Group Direction & Guidance, decisions/actions coming from battle rhythm meetings and sessions, and in-theatre incidents.

31. However, on occasions, the IM processes (and PCC) were circumvented. In these situations, some key information and its flow were no longer "visible." Examples include occasions when the forward deployed mission commander (COM NIMFOR) dispensed Direction & Guidance and tasking directly to FE Key Staff. This direct tasking was not formally captured in accordance with the procedures established in the SOPs/SOIs and resulted in taskers being generated that were not tracked via the JHQ's PCCs. In terms of JHQ information systems, bypassing the SOPs/SOIs resulted in highly significant Direction & Guidance and Taskers being dispensed via informal channels (outside of the PCCs), rather than through the formal IM system.

Summary

32. Although formal Information Management (IM) represents just one part of the overall system of information systems, IM may be viewed a complex system. The complexity is illustrated by the multiple layers of nested, interrelated and overlapping procedures and processes. As such, it is very difficult (if not impossible) to make modifications to the current system and be confident that the adjustments will achieve the desired results and not have unpredictable effects on the COM's ability to exercise effective C2.

OPERATIONAL REPORTS & RETURNS: STRAINING THE JHQ'S INFORMATION CAPACITY

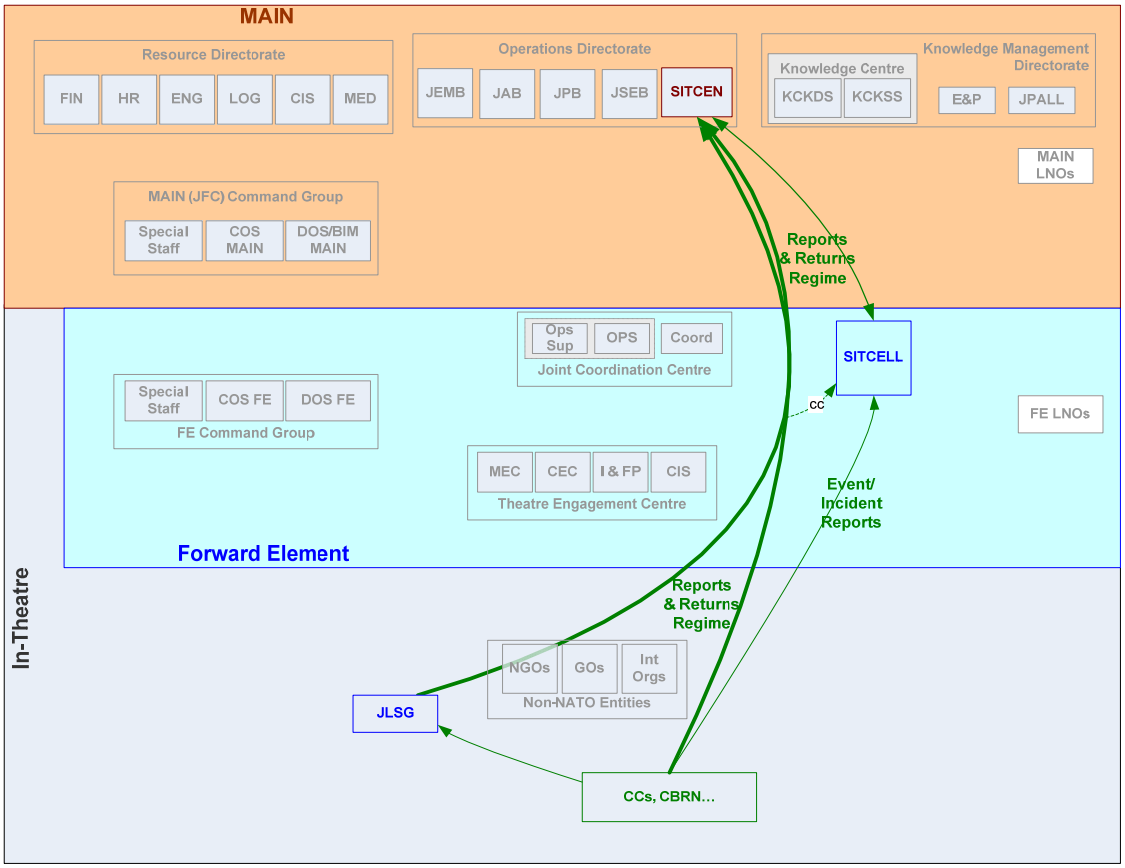

Figure 4: Operational Reports and Returns

Key Findings

33. The JHQ's Reports & Returns processes and procedures (Figure 4) also exhibit the characteristics of a complex information system.

34. The number of regularly scheduled daily/weekly reports flowing through the JHQ has the potential to utilize a significant amount of the JHQ's overall Reports & Returns system capacity. This capacity will be further taxed by Event Driven Reports & Returns, which are initiated and driven by in-theatre incidents. Overloading the JFC's Reports & Returns capacity will result in degradation of the JHQ's situation awareness.

The Contribution of Reports & Returns to Situation Awareness

35. The situation awareness of the JHQ and the COM is dependent on the regular reception, compilation, assessment, and distribution of key information. Much of this is achieved through a formal regime of incoming and outgoing reports and returns, some of which are required on a daily basis, some weekly, and others "event" driven (triggered by in-theatre incidents and/or on request by higher HQ).

36. The Reports & Returns regime for SFJE 10 was promulgated using e-mail by JFC Brunssum Support of Staff Directorate on 06 May 2010 and consisted of a total of 43 distinct categories of reports (e.g. daily Situation Assessment or Logistic Assessment Reports). Of these, 33 were incoming reports (Table 1) and 10 were outgoing (Table 2). The sources, recipients, OPRs, and delivery schedule/deadlines were specified for 28 (18 Incoming and all 10 Outgoing).

Table 1: Reports coming into the JHQ

CATEGORY: INCOMING	Type	Frequency Times per Week	Number of Individual Reports	Total Reports per Week	OPR
SITREP	Daily	7	6	42	SITCEN
LOGASSESREP	Daily	7	5	35	LRB
SAB Inputs	Daily	7	7	49	SITCEN
LOGUPDATE	Daily	7	5	35	LRB
SEWOCSUM/EWSUM	Daily	7	4	28	SEWOC
EWMSNSUM	Daily	7	4	28	SEWOC
TECHSUM	Daily	7	4	28	SEWOC
ASSESSREP	Weekly	1	5	5	JAB
GEOSITREP	Weekly	1	2	2	KCB
ENGASSESSREP	Weekly	1	6	6	JENGB
INTSUM	Event Driven		5	Variable	KCB
ENGSITREP	Event Driven		5	Variable	JENGB
CISSITREP	Event Driven		5	Variable	CISB
NBC SITREP	Event Driven		5	Variable	JSEB
PERSREP	Event Driven		5	Variable	HRB
MEDSITREP	Event Driven		5	Variable	MEDB
CIMIC Report	Event Driven		5	Variable	JEMB
MEDASSESSREP	Event Driven		5	Variable	MEDB
FRAGO	Event/On-Demand	*not specified*	*not specified*	*unknown*	*not specified*
ROEIMPL	Event/On-Demand	*not specified*	*not specified*	*unknown*	*not specified*
ROEREQ	Event/On-Demand	*not specified*	*not specified*	*unknown*	*not specified*
INTREP	Event/On-Demand	*not specified*	*not specified*	*unknown*	*not specified*
INCSPOTREP	Event/On-Demand	*not specified*	*not specified*	*unknown*	*not specified*
SPOTREP	Event/On-Demand	*not specified*	*not specified*	*unknown*	*not specified*
ELINT	Event/On-Demand	*not specified*	*not specified*	*unknown*	*not specified*
SPOTREP	Event/On-Demand	*not specified*	*not specified*	*unknown*	*not specified*
MIJIWARNREP	Event/On-Demand	*not specified*	*not specified*	*unknown*	*not specified*
ENGRECCEREP	Event/On-Demand	*not specified*	*not specified*	*unknown*	*not specified*
CASREP	Event/On-Demand	*not specified*	*not specified*	*unknown*	*not specified*
45-DAY LOSS REPORT	Event/On-Demand	*not specified*	*not specified*	*unknown*	*not specified*
FINANCIAL REP	Event/On-Demand	*not specified*	*not specified*	*unknown*	*not specified*
MANNING LIST REP	Event/On-Demand	*not specified*	*not specified*	*unknown*	*not specified*
THEATRE STRENGTH	Event/On-Demand	*not specified*	*not specified*	*unknown*	*not specified*
Total Scheduled Incoming Reports per week: 52 Categories and 258 Individual Reports					

Table 2: Outgoing Reports

CATEGORY: OUTGOING	Type	Frequency Times per week	From	To	OPR
SITREP	Daily	7	JFC MAIN	SHAPE	SITCEN
SEWOCSUM	Daily	7	JFC MAIN / SEWOC	SHAPE	SEWOC
INTSUM	Daily	7	JFC MAIN	SHAPE	KCB
GEOSITREP	Weekly	1	JFC MAIN	SHAPE	KCB
LOGASSESSREP	Weekly	1	JFC MAIN	SHAPE	LRB
ENGREP	Weekly	1	JFC MAIN	SHAPE	JENGB
ASSESSREP	Weekly	1	JFC MAIN	SHAPE	JAB
CIMICREP	Weekly	1	JFC MAIN	SHAPE	JEMB
MEDASSESSREP	Event Driven	variable	JFC MAIN	SHAPE	MEDB
PSYREP	Event Driven	variable	JFC MAIN	SHAPE	JEMB
Total Scheduled Outgoing Reports per week: 26 Categories and Reports					

37. For the total of 28 reports for which responsibilities were detailed, there were 11 different JHQ centres/branches named as OPRs (i.e. some OPRs were the responsible for more than one report, see Table 3). Each week (for the daily and weekly reports combined) the JHQ received a total of 258 individual reports. These were then consolidated by the OPRs into JHQ reports. The OPRs created ten different categories of outgoing reports for SHAPE. In total, 26 individual reports were sent to SHAPE each week.

Table 3: Identified OPRs

OPR	Responsible for		
	# Incoming	# Outgoing	Total
SITCEN	2	1	3
LRB	2	1	3
SEWOC	3	1	4
JAB	1	1	2
KCB	2	2	4
JENGB	2	1	3
CISB	1	0	1
JSEB	1	0	1
HRB	1	0	1
MEDB	2	1	3
JEMB	1	2	3

38. In addition to the routine daily and weekly reports, the Reporting Regime specified sources, destinations and OPRs for eight incoming and two outgoing "Event-Driven" reports (Tables 1 and 2, blue text). Fifteen "Other Reports" were described as "*…either event driven (to be sent as soon as possible) or to be forwarded on request of the higher HQ*" for which sources, destinations and OPRs were not specified (Tables 1 & 2, teal text). By their very nature, event-driven reports cannot be planned for in advance as they are only generated in response to incidents or requests. When they arise they result in additional tasks that the SITCEN and OPRs must work into their regular battle rhythms.

Where the Reports & Returns Process Is Vulnerable

39. Figure 5 depicts the flow of the reports and returns from the in-theatre component level into the JHQ, where they are consolidated and eventually posted on the JHQs network systems, disseminated to designated staff, and forwarded to SHAPE.

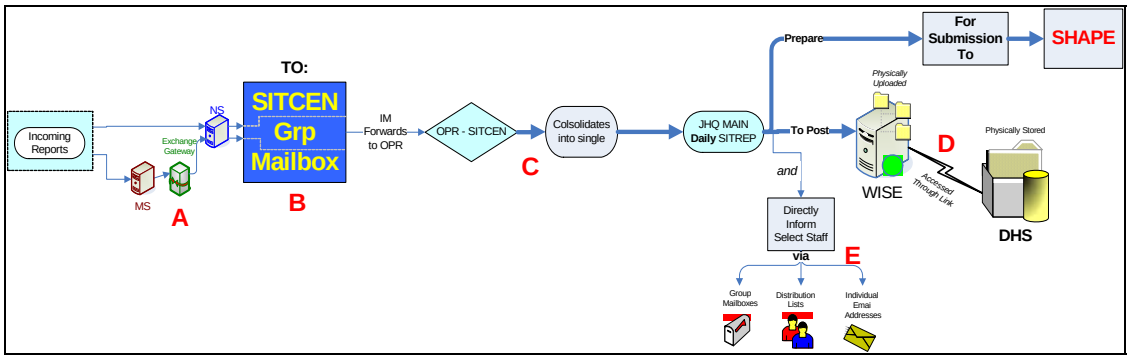

Figure 5: Sequencing, Flow and Vulnerabilities of Reports & Returns

40. The main processes/stages involve:

- Reports & Returns are sent from theatre either directly via NATO Secret (NS) channels, or, for the in-theatre entities working on Mission Secret (MS), through an intermediary Information Exchange Gateway to the NS WAN.
- Reports are received in the SITCEN mailbox and distributed to the OPR.
- Individual reports are consolidated by the OPR into a Daily/Weekly JHQ version of the report.
- After being approved for release (part of the IM processes) JHQ reports are posted on the Document Handling System (DHS)/Web Integrated Services Environment (WISE); (for some) forwarding to SHAPE; disseminating to designated JHQ staff via pre-determined/defined Distribution Lists, Common Mailboxes and Individual addresses.

41. The OPRs indicated that the time required to process and consolidate the incoming reports and generate the outgoing reports varied greatly, with estimates ranging from 15 minutes upwards to 2 hours; these times included merging the individual reports within each category. For SFJE 10, there were a total of 52 scheduled incoming reports per week that needed to be consolidated and 26 outgoing reports to be generated. If each report category takes 15 minutes, this represents a total minimum workload of 19.5 man-hours per week, whereas if each report category needs 2 hours, the total maximum workload is 156 man-hours per week. If the actual work required approaches the maximum value, there is the possibility that just the scheduled Reports & Returns may start to overload the capacity of the JHQ staff. However, the significant difference between these minimum and maximum values would suggest that additional study is required on this issue before any firm conclusions can be drawn.

42. The above numbers only address the routinely scheduled reports. The numbers and commitment required of the staff will increase if in-theatre incidents require submission of event-driven reports.

43. Notwithstanding the above discussion, it was observed that the flow of Reports & Returns did not overload the JHQ staff during SFJE 10.

44. Five points were identified within which the flow could be disrupted, access to the materials could be denied, and/or potential exists for overloading staff involved in the

reception and/or consolidation of the reports and returns. These include (Figure 5, red letters):

A: Disruption of the Reports & Returns flowing into the SITCEN due to issues associated with transferring materials from the MS to the NATO Secret networks via the Information Exchange Gateway.

B: The potential for SITCEN's group mailbox and Information Manager being overloaded in the event of large numbers of reports coming in at similar times.

C: The potential for the OPRs to be overloaded with the requirements to consolidate the individual incoming reports into the JHQ Daily and/or Weekly summary reports.

D: Lack of access to published material on the WISE or DHS due to inadequate permissions among some staff at the FE and component commands (CC).

E: The Reports & Returns systems contribution to JHQ email overload through the use of pre-determined group mailboxes, distribution lists and individual email addressees.

Reports & Returns constitute a complex system

45. Reports & Returns does constitute a complex system based on the following factors:

a. The high volume of reports, emails and other types of information flowing through the JHQ.

b. The information is comprised of multiple types/categories of inputs and outputs

c. The information originates from multiple sources (reporting entities)

d. The information routing varies depending on the OPRs and Approval Authorities

e. The volume of reference materials necessary to describe all the elements of Reports & Returns. (18 different SOPs, SOIs, Directives, Policies, and other Reports & Returns related documents were identified during this analysis).

f. The interrelationships and nesting of the various Reports & Returns SOPs and SOIs. As an example, approval and release authority for a particular report was not included in the Reports & Returns Regime Matrix and required accessing an entirely different document to determine.

g. There is no single "snapshot" of the entire Reports & Returns system. Understanding all aspects of the Reports & Returns system requires knowledge of and integration of the information contained in a wide variety of SOP, SOI, Directives, Policies and Annexes (discussed below under System of Systems).

Reports & Returns' Contribution to C2

46. Reports & Returns are a significant source of situation awareness for the COM, the JHQ and are essential for higher HQs. Accurate situation awareness is one of the cornerstones upon which COM bases his decisions and formulates his tasking and Direction & Guidance. The situation awareness that is established via this formal regime of incoming and outgoing reports is essential for the development of sound tasking, direction and guidance all of which enhance exercising of C2.

47. What this analysis was not able to determine is what contribution the various Reports & Returns make to the COM/JHQ's situation awareness. It is apparent that their importance will be mission/situation dependent. As such, this raises the question

of what are the circumstances under which the benefits derived from these reports justify the cost in time and effort required to generate them.

Summary (Reports & Returns)

48. Although the flow of Reports & Returns did not overload the JHQ staff during SFJE 10, the robustness of the Reports & Returns system and its capacity will be tested if there is an escalation of in-theatre events increasing the number of Event-driven reports required.

INFORMAL INFORMATION EXCHANGES/MECHANISMS: THE INVISIBLE LABYRINTH

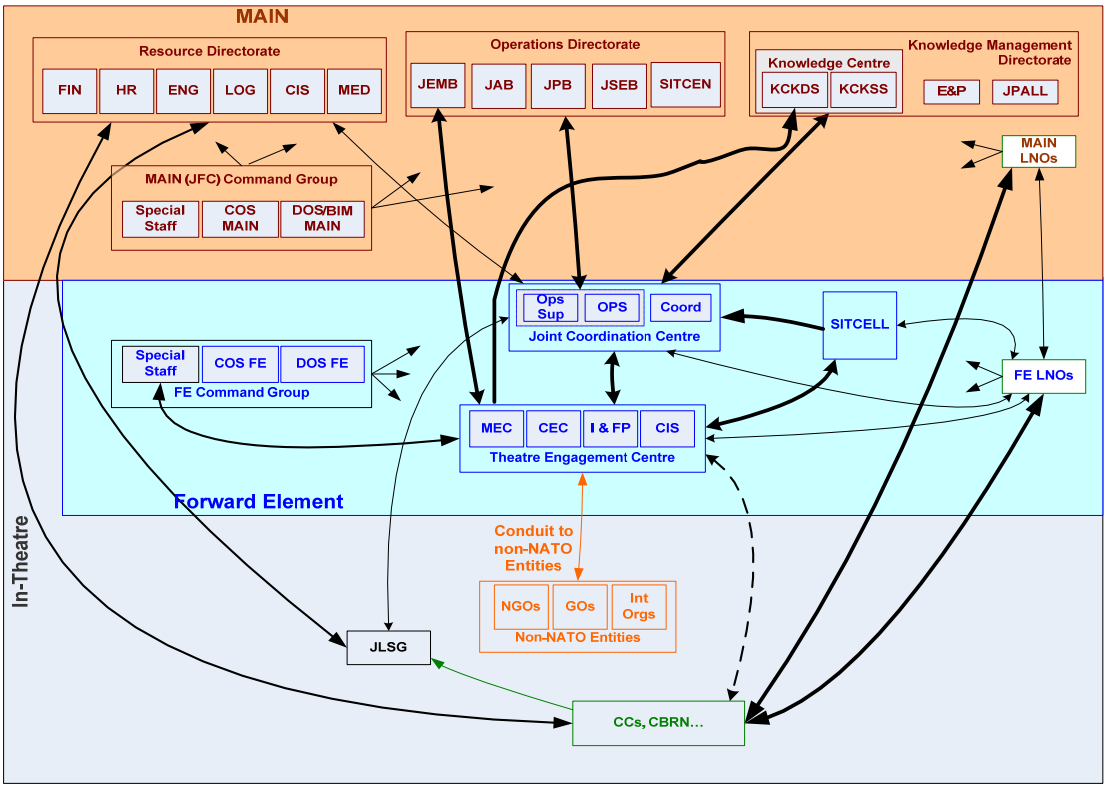

Figure 6: Informal Information Exchanges/Mechanisms

Key Findings

49. Information is exchanged within the JHQ via mechanisms which are outside the official "Information Management" and "Report & Returns Regime" processes. These exchanges occur in a variety of ways including phone, face-to-face, *JCHAT*, email, *Office Communication Software* (OCS), etc.

50. The information exchanged within the IIE/M is often transient in nature. As there are no official mechanisms in place to capture, track or manage these exchanges, the information is, at best, only partially visible across the JHQ (Figure 6).

Information Flowing "Under the IM/Reports & Returns Radar"

51. The strengths of the formal IM and the Reports & Returns systems are that they are procedurally documented and provide control mechanisms which support the tracking and management of various types of critical information. However, the JHQ's

IIE/M information flow constitutes a large volume of information that is exchanged within the JHQ outside the IM and Reports & Returns control mechanisms.

52. This difference is illustrated in Figure 2, in which all of the JHQ's key relationships and information exchange channels are shown. The Official IM exchanges take place between the COSs and the BIM–DOS of MAIN and FE (teal text and arrows of Figure 2). The Reports & Returns flow from the CCs to/through the SITCELL and SITCEN (green text and arrows of Figure 2). All of the other connections and relationships (black arrows) constitute exchanges that fall within the IIE/M system and outside IM and Reports & Returns.

Lack of Visibility, Non-permanence and the Principles of IM

53. An important distinction between the IM and Reports & Returns regimes and IIE/M is that, because the IM and Reports & Returns exchanges are visible and permanent, steps can be taken to ensure that this information is managed in accordance with the NATO Principles of Information Management. The same is not true for the IIE/M, since the exchanges are frequently not captured in any "permanent" form. For example, a report posted on the DHS or a task captured in Tasker Tracker is permanent. In contrast, a non-recorded telephone exchange between the Joint Coordination Centre Chief and the SITCEN Branch Head is transient. Capturing informal information exchanges is a very challenging issue.

54. Informal information exchange as described above does not accord with the seven NATO Principles of Information Management[6] as described in References I and M in the following ways:

a. It is a "private" rather than a "corporate" resource.

b. Information sharing, unless the information is captured and further distributed, is limited to within the perimeter of the mechanism employed for the exchange.

c. The issues within the principle of Information Standardization may not be applicable to these informal exchanges (whether transient e.g. phone calls, or more permanent e.g. JCHAT/Email).

d. Although the immediate information needs of certain individuals are addressed, others in the JHQ in need of the same information may be outside of the exchange perimeter.

Is There Adequate Guidance for IIE/M?

55. Even though IIE/M represents a significant amount of information that is exchanged within the JHQ, it is seldom directly referenced in SOPs or SOIs. The few references to "informal" information that were discovered were not IIE/M specific.

56. It was also observed that of the 34 "information related" SOPs, SOIs, Policies, Directives, and various other materials examined during the course of this analysis, none directly addressed the IIE/M exchanges. However, the following connections to IIE/M could be made:

a. There is one SOP in which Boards and Working Groups are established that can be viewed as defining venues in which certain informal information exchanges may be able to take place, although IIE/M is not specifically addressed.

[6] Information is a Corporate Resource; Information Ownership and Custodianship; Leadership and Organizational Structure; Information Sharing; Information Standardization; Information Assurance; Information Needs.

b. There are three documents in which the need for exchange of information, including more informal exchanges, is acknowledged.

c. There are four documents that address mechanisms and tools which would be likely used in the course of the IIE/M exchanges.

57. All of the above documents acknowledge that there is some degree of informal information flow required within a JHQ, but do not set the parameters to restrict these exchanges.

IIE/M Constitutes a Complex System

58. IIE/M is not covered by SOPs, SOIs and other materials as IM and Reports & Returns are. However the standardized JHQ SOPs and the JFC/DJSE tailored SOIs do emphasize the need for the JHQ MAIN and FE to establish a complex set of relationships and points of IIE/M interaction/exchange in support of the JHQ achieving "single, seamless" functionality. Figure 6 shows over a dozen key (IIE/M) connections among the MAIN, FE and CCs, in which the significant interactions and relationships were observed by the analysis team. The number of (occasionally critical) interactions indicates that IIE/M should be treated as a complex system, even though the exchanges are not clearly articulated in SOIs or SOPs, nor captured by PCC mechanisms.

IIE/M's Influence on C2

59. Many of the informal information exchanges observed occurred between Key JHQ Staff, and occasionally involved the COM. Although it may be speculated that some of these exchanges will have significant implications for effective C2, the relationship between IIE/M and effective C2 cannot be established from the data collected during SFJE 10. Further investigation of this relationship may prove fruitful.

60. One avenue in which IIE/M was demonstrated to influence C2 was via the Liaison Officers (LNO). The LNOs play a major role in the dissemination of information between the JHQ and the components, an essential element of the C2 structure. Although LNOs are required to spend significant time attending Boards and Working Groups, many of the exchanges they have with the JHQ staff and their components in support of "Integration of Command" occur in impromptu sessions and informal exchanges (i.e. IIE/M).

Multiple JFC Operations: High Workload, Limited Access

61. Although the JHQ is focussed on a single operation, the JFC may be engaged in more than one, as was the situation during SFJE 10. There will be a natural tendency for MAIN staff to be drawn into higher-priority tasks for the other operations and therefore divide their time and attention. Many exchanges occur informally via telephone, OCS and JCHAT. If the MAIN staff is not available, these exchanges will not occur, or will be delayed. The unavailability of the MAIN staff to their FE/CC counterparts may result in information exchange, decision, tasking and action delays. An underlying tenet for the success of the MAIN–FE split HQ concept depends on access to the MAIN being both available and timely.

IIE/M Summary

62. Although the IIE represents a significant amount of the information exchanges within the JHQ:

a. It takes place outside of the IM and Reports & Returns mechanisms.

b. It has little or no visibility to the overall JHQ.

c. The absence of specific examination of IIE/M in the available SOPs, SOIs and other materials implies that it does not appear to be recognized as one of the systems that are part of the overall JHQ's System of Information Flow Systems.

63. Even though IIE/M appears to constitute one of the complex information systems comprising the overall System of Systems, its impact on and interactions with the IM and Reports & Returns are unclear. Closer examination will be required to understand its influence on the other systems and the implications for the System of Systems, as a whole.

OVERALL INFORMATION FLOW THROUGH THE JHQ

Key Findings:

64. The overall dynamic flow of information through the JHQ appears to be a system of systems which is neither clearly documented nor understood. As such, it is currently not feasible to:

- Determine whether the individual systems as parts of the overall system are designed in the most effective and efficient manner to support the management of the JHQ's overall information flow.
- Predict the consequences resulting from the interactions of all the systems (e.g., unanticipated routing of the information).

Information Flow

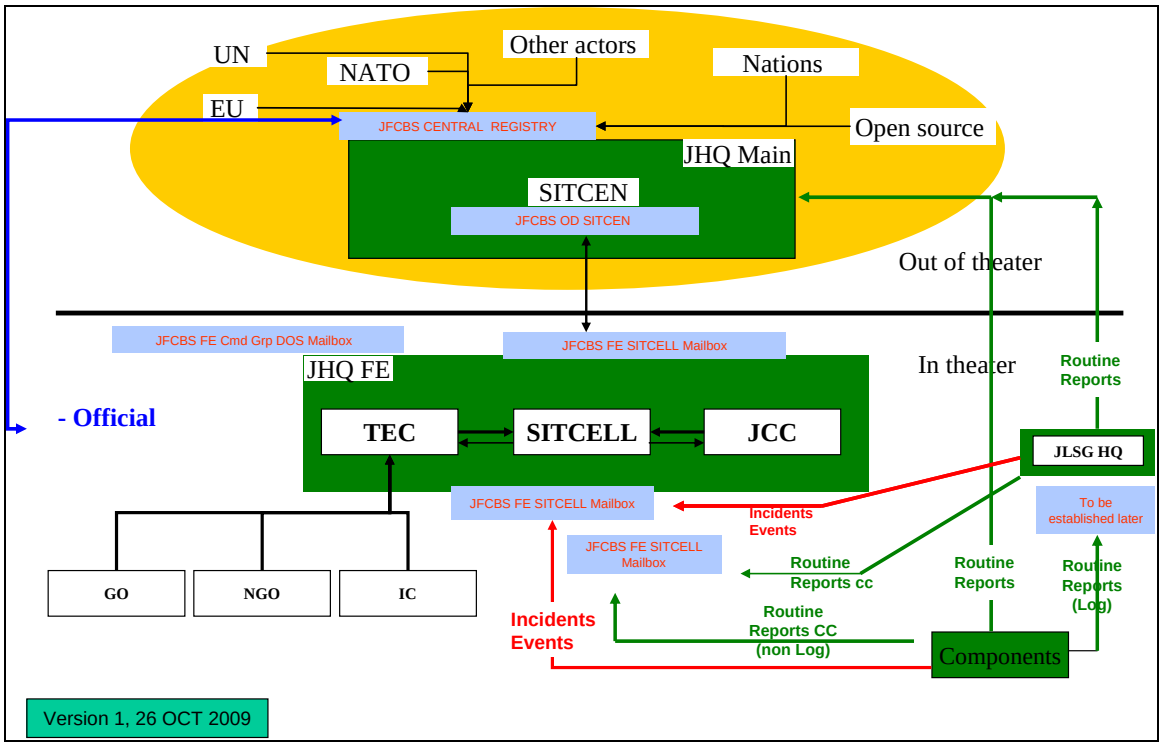

Figure 7: Information Flow through the JHQ (SOI-nn)

65. Figure 7, taken from the JFC SOI-nn (Reference D) depicts the overall Information Flow construct for JFC Brunssum as implemented in SFJE 10. The top central and lower central (both green) rectangles represent the JHQ MAIN and FE respectively. The components are represented by the smaller green rectangle towards the lower right of the diagram.

66. The IM and the Reports & Returns processes are described in detail in a variety of SOPs and SOIs and the entire Reports & Returns system is represented in the diagrams by the set of green arrows that run from the Components and JLSG to the SITCEN and SITCELL. The figure shows that the Reports & Returns flow into the JHQ is SITCEN/SITCELL centric.

67. The complexity of the IM system is not well illustrated in Figure 7. Although the flow of reports originating from in-theatre incidents is depicted by the red arrows (lower right) running from the Components and JLSG to the FE, the flow into and within the JHQ and eventual tasking is not. In comparison, the blue arrow in the upper left (from MAIN Central Registry towards the FE Command Group DOS mailbox) is the sole depiction of the remaining Command Group tasking flow that originates from Official Correspondence, COM/Command Group Direction & Guidance, and Battle Rhythm sessions. The fact that IM is BIM–DOS centric is not clear.

68. Although one can deduce from Figure 7 where the IM and Reports & Returns exchanges occur, the IIE/M exchanges are not directly acknowledged.

Understanding the Individual Systems as a System of Systems

Table 4: SOP, SOI & Other Information Flow References

SOP SOI Annex Directive Policy	IM	R&R	IIE/M
JFC Brunssum SFJE 10 OPLAN: Annex CC: Information Management	X		
JFC Brunssum SFJE 10 OPLAN: Appendix 1 To Annex CC: NRF Battle Rhythm	X		X[1]
JFC Brunssum SFJE 10 OPLAN: Appendix 4 to Annex CC: Electronic Working Practices	X	X	
JFC Brunssum SFJE 10 OPLAN: Appendix 5,Annex CC:NRF Exchange/Outlook Structure &Management	X	X	
JFC Brunssum SFJE 10 OPLAN: Appendix 7 To Annex CC: Records Management	X	X	X[2]
JHQ SOP 123, Annex A. Crit. Info Management	X		
JHQ SOP 228 Annex A: IM Personnel Roles and Responsibilities	X		
JHQ SOP 228 Annex B: Collaborative Tools	X	X	X[3]
JHQ SOP 228 Annex C: Life Cycle of Information	X		
JHQ SOP 228 Annex D: Standard Web Page	X	X	
JHQ SOP 228 Annex E: Rules for Best Practice of Information Exchange	X		
JHQ SOP 228 Information Management	X		
JHQ SOP 232 Reports Returns and Orders		X	
JHQ SOP 232 RepRetOrd Annex A Appendix 1 ASSESSREP Example		X	
JHQ SOP 232 RepRetOrd Annex A ASSESSREP Format		X	
JHQ SOP 232 RepRetOrd Annex B SITREP Format		X	
JHQ SOP 232 RepRetOrd Annex C Daily & Event Driven Reports		X	
JFC Brunssum SOI SOI-nnn Annex A: Information Flow Diagram	X	X	
JFC Brunssum SOI SOI-nnn Annex B: Information Flow Matrix within DJSE Concept	X	X	
JFC Brunssum SOI SOI-nnn Annex C: Process Flow Formal Correspondence	X		
JFC Brunssum SOI SOI-nnn NRF Information Flow within JHQ	X	X	X[2]
JFC Brunssum SOI-nn Annex B1: Process Flow Tasking	X		
JFC Brunssum SOI-nn Annex B2: Process Flow Approval & Release	X	X	
JFC Brunssum SOI-nn: Tasking Procedures within the Joint Headquarters	X		
JFC Brunssum Frago 001/JSEB SFJE 10: Reporting Regime		X	
JFC Brunssum Outlook Group Mailboxes & Addressing Scheme	X	X	X[3]
JFC Brunssum Reports and Returns Distribution List		X	
Bi-SC Directive 25-1, Information and Knowledge Management (IKM).	X		
C-M(2007)0118: NATO Information Management Policy (NIMP).	X		
NCSA ASI A 02-02, Operational Procedure for Naming and Addressing for the NATO AIS Infrastructure.	X		
C-M(2008)0113: The Primary Directive on Information Management (INV)	X		
JHQ B Directive 15-5 Staff Handbook (January 2010)	X	X	X[2]
JHQ B Directive 15-5 Appendix 1 to Annex G: JHCB HQ Standardized Distribution Lists	X	X	X[3]
JHQ B Directive 15-5 Annex G: JHCB HQ Electronic Office Mailbox List	X	X	X[3]

X[1] = IIE/M not directly addressed, but ***informal exchanges could occur in the venues***

X[2] = IIE/M not directly addressed, but does ***acknowledge types and importance of informal exchanges***

X[3] = IIE/M not directly addressed, but the ***informal exchanges would likely use these mechanisms***

Blue Text = JFC / Mission Specific Materials

69. Understandably, the totality of the JHQs information systems is more complex than can be captured in a single diagram, such as Figure 7. The fact that more than 30 documents address the various Information Flow issues attests to this. As such, Table 4 was constructed to help visualize the extent of the complexity and the interrelationships among the systems. The table lists 34 Information Flow related SOPs, SOIs, , Policies, Directives, and other documents that were identified during the course of this analysis (note that annexes and appendices that address specific, individual aspects of Information Flow have been included as separate entries in this

table). However, this matrix is not able to portray the complexity of the interrelationships and overlaps among these documents.

70. It can also be more clearly seen from Table 4 that:

a. Little documentation is specifically dedicated to informal exchanges.

b. More than half of the documents (blue text) are JFC (SOI, Handbook) or mission Operation Plan (OPLAN) specific which means that they will change depending on the mission and/or the particular JFC. This will require FC DJSE adjustment each time the FC DJSE is associated with a different JFC or mission.

71. Of the 34 total documents detailed in Table 4:

a. 13 are IM specific.

b. 7 are Reports & Returns specific.

c. 6 are IIE/M specific.

d. 6 address both IM and Reports & Returns.

e. 1 addresses both IM and IIE/M.

f. 0 address both Reports & Returns and IIE/M.

g. 5 address all three systems.

72. Figure 8 is a Venn diagram that illustrates the three systems and the overlaps of the documents detailed in Table 4. When conducting future analyses on the information flow in a HQ, Figure 8 could be the departure point firstly to identify where there are gaps and secondly to obtain a complete picture of the information flow.

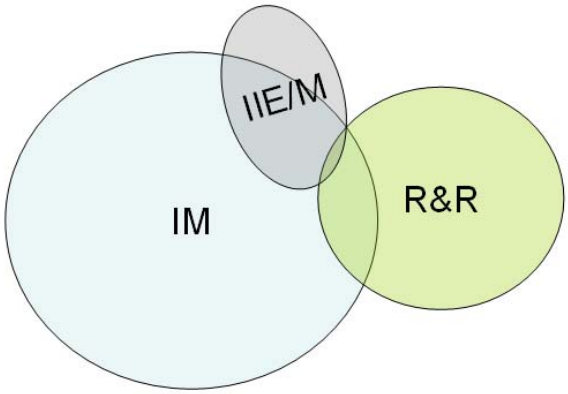

Figure 8: Current perception of the systems

73. Identifying the common documents only provides indications as to where interrelationships exist and interactions may occur. Moreover, the documents themselves do not detail the interrelationships, interactions and overlaps that are needed to understand how the individual systems function as an overall system of systems.

74. Although IM, Reports & Returns and IIE/M are clearly separate systems, together they display traits that are consistent with those of a System of Systems (Reference N), including:

a. Operational Independence of Elements: If the system of systems is disassembled into its component systems those component systems must be able to effectively

operate independently. The system of systems is composed of systems which are independent and useful in their own right.

b. Managerial Independency of Elements: The component systems not only can operate independently, they do operate independently. The component systems are separately acquired and integrated but maintain a continuing operational existence independent of the system of systems.

c. Evolutionary Development: The system of systems does not appear fully formed. Its development and existence are evolutionary with functions and purposes added.

d. Emergent Behaviour: The system performs functions and carries out purposes that do not reside in any component system. These behaviours are emergent properties of the entire system of systems and cannot be localized to any component system.

e. Geographical Distribution of Elements: The geographic extent of the component systems is large[7].

75. The challenge will be to begin to see all of these systems as a single overarching system in which the unique aspects of the individual systems, their contribution to the whole, interactions and interdependencies, are recognized (Figure 9).

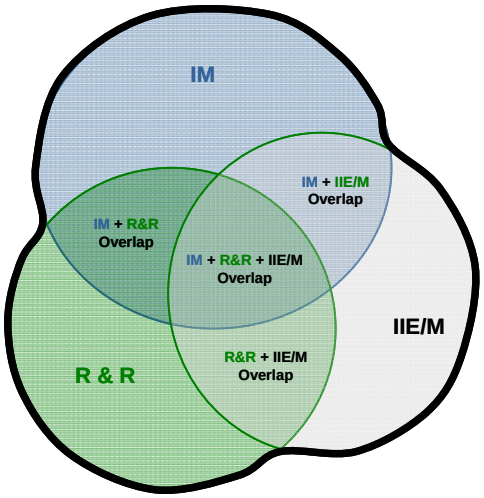

Figure 9: System of Systems

Summary: Information Flow as a System of Systems

76. Information flow through a JHQ involves a System of Systems consisting of three identified Systems. Policy, Directives, SOPs, SOIs and other documentation only indirectly address IIE/M, and do not detail the interrelationships, interactions and overlaps that are needed to understand how the individual systems function as an overall system of systems.

77. Establishing that a system of information systems exists is just the first step in managing the overall information flow of the JHQ. A full understanding requires:

- Development of a unifying lexicon that bridges all of the individual systems.
- Development of an overall architecture that unifies the individual systems.
- Employment of appropriate analysis techniques, e.g. Social Network Analysis, to capture the system requirements, concepts, and technologies.

[7] Large is a nebulous and relative concept as communication capabilities increase.

4
Command & Control

KEY FINDINGS

78. The official chain of command was clearly understood at all levels and the delegation of command (from COM to DCOM) during the exercise had no discernible impact on the exercising of effective C2.

79. The employment of LNOs during SFJE 10 was effective and directly supported the NATO doctrinal principle of Integration of Command.

80. The new JFC Peacetime Establishment and the DJSE concept structures are not inconsistent or incompatible with exercising command and control in an NRF-type mission. However, the timing required for planning and deploying on rapid reaction missions, along with the realities that the JFC COM must attend to more than just the NRF mission, will challenge adherence to some of NATO's Principles of Command. The rationale behind the C2 structures adopted by JFC Brunssum for SFJE 10 were consistent with the lessons identified in prior Deployable Joint Task Force (DJTF)/DJSE C2 analyses.

SFJE 10: DELEGATION OF COMMAND

81. The variations of the physical location of the COM during SFJE 10 are diagrammed in Figures 10, 11 and 12. The black boxes in each represent positions and the blue boxes represent specific individuals.

82. At the beginning of SFJE 10 (Figure 10), COM JFC was in theatre in the *position* of COM NIMFOR (**A**). DCOM JFC (**B**) and COS JFC (**C**) remained in the MAIN to coordinate across the JFC's multiple operations. The forward DCOM NIMFOR (**D**) position was vacant, although DCOM JFC closely monitored the NRF mission. The figure also shows that COM JFC's Special Staff (**E**) deployed in-theatre with the COM and filled the mission focused Deployed Special Staff positions.

83. Figure 11 depicts the C2 situation just prior to the delegation of COM NIMFOR responsibilities from COM JFC to DCOM JFC. The figure shows COM JFC still in theatre (**F**) and DCOM JFC now in-theatre (**G**) temporarily filling the DCOM NIMFOR position.

84. Figure 12 depicts the arrangement following COM JFC's (**H**) departure with DCOM JFC designated as COM NIMFOR (**J**). Note that it was decided to have the majority of the COM JFC Special Staff remain with the FE as the JFC Deployed Special Staff (**K**).

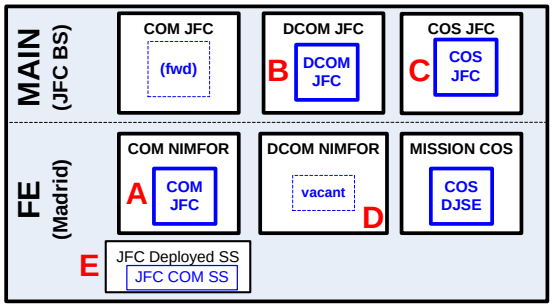

Figure 10: C2 with COM JFC

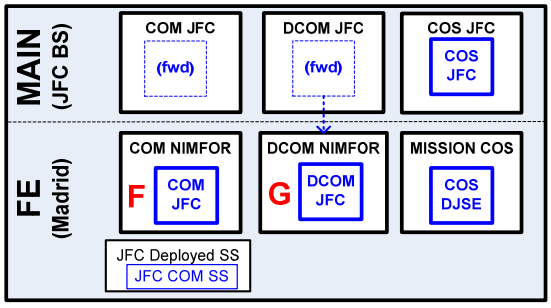

Figure 11: C2 during Transition

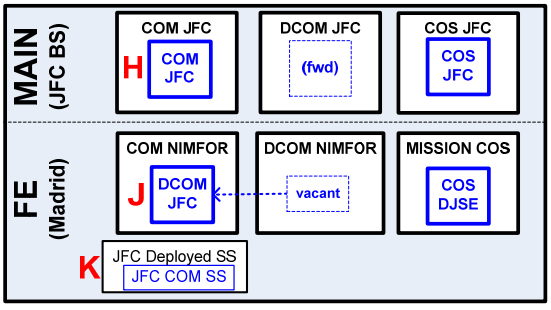

Figure 12: C2 with DCOM JFC Forward

85. The authority delegated to DCOM, when he assumed COM NIMFOR roles responsibilities, was full and had no constraints. The actual handover itself was observed to be very smooth, with the time (*"…10 May 1800 hrs to 14 May 1800 hrs"*) and conditions (*"…will accept the roles and responsibilities of COM NIMFOR"*) being articulated in an official letter from COM JFC Brunssum to Supreme Allied Commander Europe.

86. JFC Brunssum DCOM preparations in advance of the SFJE 10 delegation of command included his attendance at all NRF activities (Video Teleconferences, meetings, etc.) alongside JFC COM and having access to all NRF materials. In this way, he was fully cognizant of all issues, arrangements, "how COM was doing business," etc.

87. Upon COM's return to theatre, a reverse handover occurred with COM JFC reassuming COM NIMFOR duties from DCOM JFC who returned to JFC Brunssum. Overall, the mechanisms JFC Brunssum had in place for the handover of NIMFOR command from COM JFC to DCOM JFC were clearly articulated and effective.

The Logic Underlying the Selection of COM NIMFOR

88. COM JFC's final decisions with respect to the selection of COM NIMFOR were predicated on lessons learned from the Live Exercise STEADFAST JAGUAR 06, when the forward 2-star COM DJTF struggled to exercise command authority over other higher ranking, in-theatre component commanders. As such, COM JFC adopted the following guidelines:

a. The rank of the forward COM (COM NIMFOR) needed to be of equal or senior rank to the other mission participants (commanders of the LCC, Air Component Command (ACC), Maritime Component Command (MCC), JLSG, the FE COS, etc.). In SFJE 10, this dictated that the acting COM NIMFOR be at least 3-star.

b. Of the two 3-star flag officers in JFC Brunssum, JFC Brunssum DCOM was designated as the officer who would assume COM NIMFOR responsibilities, in theatre, when COM JFC Brunssum would depart.

c. Factors influencing the selection of DCOM rather than JFC Brunssum COS included:

- Since the static MAIN is an integral part of the JHQ, JFC Brunssum COS was needed in MAIN to coordinate and manage the MAIN, and to be the MAIN contact for the Bi-COS Coordination between MAIN and FE.
- Although the two COSs had not worked together extensively prior to SFJE 10, they had had some previous contact which was felt should be leveraged to support the SFJE 10 JHQ COS–COS relationship.

89. Interviews indicated that this official chain of command was clearly understood and the handover (from COM to DCOM) did not create any confusion among any of the subordinate command staffs (FE, CCs, etc.) with the authority of the DCOM as COM NIMFOR being fully accepted and respected.

90. It is important to note the role played by lessons identified from previous exercises to the successful delegation of command authority during SFJE 10. Had this not been done, this section might be focusing more on problems than successes, and demonstrates that those lessons identified were actually learned.

LNOs IN SUPPORT OF C2

91. Overall, the components employed LNOs very effectively which supported the integration of the assigned forces. A contributory factor to this effective employment of

LNOs was that the LCC, ACC, and MCC selected experienced, knowledgeable flag officers (OF-6s and OF-7s) to serve as their eyes, ears and spokespersons in the FE, and each carried documentation of their Level of Authority. The liaison cells consisted of two to five individuals, except the ACC, which deployed a ten-person Air Liaison Element (ALE)[8]. It gave them a very strong and versatile presence (an OF-7 director plus some INTEL, Logistics and Planning capabilities). Overall, the employment of LNOs during SFJE 10 was consistent with and supported achievement of the NATO doctrinal principle of Integration of Command.

ADHERENCE TO THE NATO COMMAND AND CONTROL PRINCIPLES

92. The principle of Continuity of Command (he who plans, executes) may be violated by:

a. The reality that the NATO level of ambition requires each JFC to be capable of conducting concurrently more than one operation.

b. The time needed to plan an operation.

c. In the context of military concept for NATO's Deployable Joint Staff Elements, the split HQ concept with the requirement to deploy rapidly a small footprint FE.

93. Actions taken by JFC Brunssum for SFJE 10 that helped to mitigate the potential for disruptions in the continuity of command, and that should be considered as best practices, included:

a. Having the COM, DCOM and COS, all involved throughout the Crisis Response Planning phase.

b. Having the Chief Joint Operational Planning Group (JOPG), a person heavily involved in the planning from the beginning, deploy forward as part of the COM's special staff.

[8] Referred to as an Air Component Coordination Element (ACCE) at the exercise; although this designation is commonly used, it is not in line with applicable doctrine (AJP-3.3).

5
Conclusions and Recommendations

CONCLUSIONS

94. The following conclusions are separated into three sections:

a. Generic conclusions concerning the overall analysis requirement—to provide a better understanding of the information flow between the JHQ MAIN and FE elements and its relationship to effective C2.

b. Specific conclusions relating to analysis objective 1, which examine the information flows within the JHQ, and between the JHQ and subordinate commands.

c. Specific conclusions relating to analysis objective 2, which address specific issues raised by JFC Brunssum regarding the impact on the information flow and C2 of the nomination of a FE DCOM and the impact of multiple missions.

General

95. The overall flow of information through the JHQ is a system of three systems: Reports & Returns, formal Information Management, and informal information exchanges, all of which exhibit certain characteristics of complex systems.

96. The information flow system of systems is neither clearly documented nor understood. As such, it is currently not feasible to determine whether the individual systems, as parts of the overall system, are optimally designed to support the management of the JHQ's overall information flow.

97. The complexity of the processes and difficulties in tracking and managing the information, even within the formal information management system, may impact both the COM's ability to exercise effective C2 and the efficiency of the JHQ.

98. The lack of detail in the relevant JHQ SOP for IM has resulted in each JFC developing its own IM SOIs, creating challenges when a JHQ is formed by integrating an FE—for which the two NATO FCs provide the majority of the staff—with a MAIN staff from one of three JFCs.

Analysis Objective 1

Sub-Analysis Objective 1.1

99. Information is exchanged within the JHQ via mechanisms which are outside the official "Information Management" and "Report & Returns Regime" processes. These informal information exchanges are unavoidable, part of the life of a HQ, and occur in a variety of ways, including phone, face-to-face, JCHAT, email, OCS, etc. There are no official mechanisms in place to capture, track or manage these exchanges which render it nearly invisible and, in many cases, transient data. In terms of NATO's Principles of Information Management, they appear to be a potential vulnerability.

100. Direction, guidance and tasking from the COM which was not captured and disseminated within the formal IM mechanisms (as required by the SOPs/SOIs) resulted in highly significant information being dispensed via informal channels rather than through the formal IM system; this degraded the efficiency of the JHQ staff and may have compromised the COM's ability to exercise effective C2.

Sub-Analysis Objective 1.2

101. The number of regularly scheduled daily/weekly reports flowing through the JHQ has the potential to utilize a significant amount of the JHQ's Reports & Returns system capacity, but further investigation is required into this issue before firm conclusions can be drawn. Event-driven Reports & Returns, which are initiated and driven by in-theatre incidents, represent an additional load on the system. Overloading the JFC's Reports & Returns capacity will result in degradation of the JHQ's situation awareness.

Analysis Objective 2

Sub-Analysis Objective 2.1

102. The chain of command, as put in place during SFJE 10, was clearly understood at all levels and the delegation of command (from COM to DCOM) during the exercise had no discernible impact on the exercising of effective C2. The actions adopted by JFC Brunssum for SFJE 10 to mitigate possible undesirable consequences resulting from a change in the Commander were effective: these included taking note of lessons identified during previous exercises and the deployment of the Chief JOPG as part of the COM's special staff in the FE.

Sub-Analysis Objective 2.2

103. Multiple operations for a JFC may require some JHQ MAIN staff to divide their time and attention between operations. As a result, the MAIN staff may be less accessible and responsive to the staff of the JHQ FE and the CCs who remain focussed on a single operation.

RECOMMENDATIONS

Information Flow

104. Analyse the entire flow of information through the JHQ in the context of a system of systems comprising of formal IM, Reports & Returns and IIE/M processes, procedures and mechanisms, with the goals of:

a. Developing a unifying lexicon that bridges all of the individual systems.

b. Developing an overall architecture that provides for formal information capture and management without compromising the flexibility provided by informal information exchanges.

IM Architecture

105. Analyse the overall IM architecture with respect to the particular requirements arising out of the split MAIN–FE JHQ; and from the understanding gained:

a. Ensure that future IM architectures are designed to simplify the information flow and reduce the nesting of procedures within other procedures.

b. Develop a JHQ IM SOP with sufficient detail to discourage heavy reliance on non-standardized SOIs.

Reports & Returns

106. Carry out a judicious review of all Reports & Returns to meet the information requirements of both the JHQ and higher command, to ensure that the Reports & Returns regime:

a. Meets the minimum requirement, with additional Reports & Returns requiring justification for inclusion.

b. Is in compliance with the NATO Principle of Information Management concerning information needs of the JHQ staff.

c. As far as possible, distributes the Reports & Returns workload across the JHQ staff.

107. Promulgate a standard Reports & Returns regime matrix in the JHQ SOP.

Informal Information

108. Conduct further analysis to identify the full nature of the informal information exchanges within the JHQ that are neither captured nor visible via the official IM and Reports & Returns processes, with the following aims:

a. Determine the nature of the information exchanged, among whom it is exchanged, the channels and mechanisms that are employed, and whether its visibility across the JHQ is desirable.

b. Determine if existing IM and Reports & Returns mechanisms and procedures could be leveraged or modified to capture the informal exchanges, or if additional mechanisms/procedures need to be developed.

Maintaining continuity of command

109. Continue to include the Chief JOPG as part of the COM's Special Staff to maintain continuity between the planning and execution.

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Annex A
Glossary of Acronyms

ACC	Air Component Command
ACCE	Air Component Coordination Element
AJP	Allied Joint Publication
ALE	Air Liaison Element
BIM	Business Information Management
C2	Command and Control
CC	Component Command
COM	Commander
COS	Chief of Staff
DCOM	Deputy Commander
DHS	Document Handling System
DJSE	Deployable Joint Staff Element
DJTF	Deployable Joint Task Force
DOS	Director of Staff
FC	Force Command
FE	Forward Element
IIE/M	Informal Information Exchanges/Mechanisms
IM	Information Management
JALLC	Joint Analysis and Lessons Learned Centre
JFC	Joint Force Command
JHQ	Joint Headquarters
JLSG	Joint Logistics Support Group
JOPG	Joint Operations Planning Group
LCC	Land Component Command
LNO	Liaison officer
MCC	Maritime Component Command
MS	Mission Secret
NIMFOR	NATO Interim Mission Force
NRF	NATO Response Force
NS	NATO Secret
OCS	Office Communication Software
OPLAN	Operation Plan
OPR	Office of Primary Responsibility

PCC	Planned Control Capabilities
SFJE	Steadfast Juncture
SITCELL	Situation Cell
SITCEN	Situation Centre
SOI	Standing Operating Instructions
SOP	Standing Operating Procedures
SS	Special Staff
WISE	Web Integrated Services Environment

Annex B
Lessons Learned Database Entries

Lesson 1119
Reports & Returns

Observation

During SFJE 10, the JALLC conducted an analysis of the information flow through the Joint HQ comprised of separate MAIN and Forward Element. It was observed that the Reports & Returns comprised one part of the information flow that challenged the JHQ staff to be able to manage it.

Discussion

The situation awareness of the JHQ staff, the COM, and SHAPE is dependent on the regular reception, compilation, assessment, distribution, and dissemination of key information. Much of this is achieved through a formal regime of incoming and outgoing reports and returns, some of which are required on a daily basis, some weekly, and others "event" driven (triggered by in-theatre incidents and/or on request by higher HQ).

The Reports & Returns regime for SFJE 10 consisted of a total of 43 distinct categories of reports (e.g. daily Situation Assessment or Logistic Assessment Reports). Of these, 33 were incoming reports and 10 were outgoing to SHAPE. The sources, recipients, office of primary responsibility (OPR), and delivery schedule/deadlines were specified for 28 (18 Incoming and all 10 Outgoing); of these 18 incoming reports, ten were regular weekly or daily scheduled reports. Each week (for the daily and weekly reports combined) the JHQ received a total of 258 individual scheduled reports and were required to produce 26 reports for SHAPE.

In addition to these scheduled Reports & Returns, an additional 23 incoming event-driven and two outgoing event-driven reports were detailed in the Reports & Returns regime matrix.

Although there was no evidence observed during SFJE 10 that the capacity of the JHQ staff to consolidate, process and produce the required Reports & Returns was overloaded, the robustness of the Reports & Returns system and its capacity will be tested if there is an escalation of in-theatre events increasing the number of Event-driven reports required.

Under the DJSE concept, where different NATO HQs provide staff for the MAIN and FE, this lack of standardization may lead to inefficiencies.

Conclusions

The number of regularly scheduled daily/weekly reports flowing through the JHQ has the potential to utilize a significant amount of the JHQ's Reports & Returns system capacity, but further investigation is required into this issue before firm conclusions can be drawn. Event-driven Reports & Returns, which are initiated and driven by in-theatre incidents, represent an additional load on the system. Overloading the JFC's Reports & Returns capacity will result in degradation of both the JHQ's and SHAPE's situation awareness.

Recommendations

Carry out further investigation and a judicious review of all Reports & Returns to meet the information requirements of both the JHQ and higher command, to ensure that the Reports & Returns regime:

a. Meets the minimum requirement, with additional Reports & Returns requiring justification for inclusion.

b. Is in compliance with the NATO Principle of Information Management concerning information needs of the JHQ staff.

c. As far as possible, distributes the Reports & Returns workload across the JHQ staff.

Promulgate a standard Reports & Returns regime matrix in the JHQ SOPs.

Lesson 1120
System of Information Systems

Observation

During exercise SFJE 10, the JALLC conducted an analysis of the information flow through the Joint HQ comprising a MAIN and Forward Element. It was observed that the overall flow of information through the JHQ is a system of three individual information systems, each of which exhibits characteristics of a complex system. The overall flow of information was not clearly understood and therefore its coherency was uncertain.

Discussion

The three individual information systems are:

a. Formal Information Management (IM): Official Correspondence, Command Group generated tasking and direction & guidance which flows primarily through the BIM–DOS channels.

b. Operational Reports and Returns (R&R): Daily, Weekly and Event Driven Reporting Regime which flows primarily from in-theatre into the JHQ via the SITCEN/SITCELL

c. Informal Information Exchanges & Mechanisms (IIE/M): All exchanges that take place within the JHQ that are neither captured nor visible via the IM and R&R mechanism.

The complexity of the processes and difficulties in tracking and managing the information in these systems—even within the formal IM system—compound into a system of systems that is insufficiently understood, This lack of understanding:

- does not ensure an efficient and effective overall JHQ information flow and,
- prevents a clear documentation of the overall JHQ information flow system of systems.

It is therefore currently not possible to determine whether the overall JHQ information flow systems, and the constituent individual systems are optimally designed to support the management of the JHQ's overall information flow and hence the COM and his staff.

Conclusion

A sub-optimal JHQ information flow system may impact both the COM's ability to exercise effective C2 and the efficiency of the JHQ.

Recommendations

Analyse the entire flow of information through the JHQ in the context of a system of systems comprising formal IM, Reports & Returns and IIE/M processes, procedures and mechanisms, with the goals of:

a. Developing a unifying lexicon that bridges all of the individual systems.

b. Developing an overall architecture that provides for formal information capture and management without compromising the flexibility provided by informal information exchanges.

Lesson 1121
Information Management Architecture

Observation

During exercise SFJE 10, the JALLC conducted an analysis of the information flow through the Joint HQ comprising a MAIN and Forward Element. The split MAIN-FE JHQ has the potential to pose particular information flow problems.

Discussion

IM architectures reflect complex information flows and lead to a nesting of IM procedures within other procedures. The lack of detail observed in the relevant JHQ SOP has resulted in each JFC developing its own IM SOIs, creating challenges when a JHQ is formed by integrating an FE—for which the two NATO FCs provide the majority of the staff—with a MAIN staff from one of three JFCs. This leads to heavy reliance on non-standardized SOIs.

Conclusion

The IM architecture for the split JHQ requires a more detailed JHQ IM SOP if the use of non-standardized SOIs is to be minimized

Recommendations

Analyse the overall IM architecture with respect to the particular requirements arising out of the split MAIN–FE JHQ; and from the understanding gained:

a. Ensure that future IM architectures are designed to simplify the information flow and reduce the nesting of procedures within other procedures.

b. Develop a JHQ IM SOP with sufficient detail to discourage heavy reliance on non-standardized SOIs.