Multi-Agency Operations: Cooperation During Flooding

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1 Executive Summary

This report presents an investigation of command and control during multi-agency operations, focusing specifically on military involvement in civil emergencies and on Search and Rescue activity. This work follows on from an earlier report for Work Package 3.1.4, which examined the multi-agency response to the bomb attacks in London on 7th July 2005. The purpose of the current research was to identify:

- How does the context of the situation force responding agencies away from formal structures and procedures?
- How is Command Intent managed across ad hoc and fragmented systems?
- How could technology be used to support multi-agency operations?

In order to do this, three scenarios have been examined. The first was the combined military and civilian defence of Walham electricity substation from rising floodwater in July 2007. During the widespread flooding last summer, Gloucestershire was particularly badly affected, to the extent that the emergency services were unable to cope and a formal request for Military Aid to the Civil Authorities (MACA) was made. The second scenario looked at maritime and mountain Search and Rescue and used social network analysis to identify issues relating to Command Intent and Situation Awareness. The third scenario was based on the flooding of the coastal town of Boscastle in August 2004 and formed the focus for a discussion of emergency response activity. This analysis was performed on the basis of available archive material.

The scenarios in this report are used to explore four key aspects of multi-agency coordination, namely the formulation and communication of Command Intent, the Organisational Structures used to coordinate activity, Inter-agency Cooperation during the incident response and the development and maintenance of Shared Awareness within and across agencies.

Whilst the responses to these emergencies were successful, a number of adaptations to standard organisational structures, processes and procedures were necessary. Our analysis identified some issues in terms of Shared Awareness and Inter-agency Cooperation, which partly related to inexperience in working together, though which may also stem from a more fundamental question over the recognition of command authority.

Our previous report (McMaster et al., 2007) suggested the development of a Common Operational Picture could improve the dissemination of incident information. Whilst this may bring some improvements, the current research suggests that the sharing of information alone is insufficient to result in a coordinated approach to an incident; a deeper, shared understanding of the relevant factors in the incident is required. However, this is more effortful to achieve and likely to be harder to support with contemporary networking technologies.

We also argue that effective coordination requires a high level of trust between responding organisations, as the ‘problem space’ is likely to extend beyond the expertise
of any one group and therefore they are reliant on each other’s expertise. This report supports the sociotechnical systems view of the implementation of NEC, i.e. that the development of networking technologies must also take account of the social processes that form an important component of command and control and inter-agency cooperation.
2 Introduction

2.1 Multi-Agency Operations

During recent years, both multi service and multi national cooperation have become the norm for British military operations, as demonstrated during both war fighting and peacekeeping roles in Kosovo, Afghanistan and Iraq. Whilst these operations may at times have required a high degree of cooperation between services, this is not the norm and a level of exclusivity of tasks means that a certain amount of independence of operation has been retained.

In order to maximise the potential of Network Enabled Capability (NEC), a further massive increase in the tempo and level of coordination across military forces, commanders and individual units will be required, i.e. forces and resources will become interdependent. What is currently unclear is how this move to more dynamic interactions within and between agencies will affect the role of command, current organisational structures and processes. The negative consequences of failures to ‘synchronise’ during multi-agency operations have been demonstrated during wartime on a number of occasions, where military units have engaged ‘targets’ which were subsequently found to be allied forces; therefore, there is a pressing need to study these types of operations and to make timely recommendations, should changes be required.

2.2 Description

In this report, we describe a study of command and control (C2) processes and multi-agency cooperation during emergency responses. This work follows on from our earlier analysis of the initial response to the terrorist attacks in London on 7th July 2005, which is described in McMaster, Baber and Houghton (2007).

This report is also part of two ongoing HFI DTC work packages – 3.1.3 and 3.1.4 – that address command intent and multi-agency operations.

2.3 Scenarios used

Three scenarios have been chosen, which have enabled us to identify and discuss a number of relevant points regarding command and control of multi-agency operations:

2.3.1 Gloucestershire floods and Walham substation

During the heavy rain and flooding in the United Kingdom in June and July 2007, Gloucestershire was particularly badly affected, to the extent that the emergency services were unable to cope and military assistance was requested. Over one thousand military personnel were involved in Search and Rescue, water distribution and flood defence construction over a ten-day period in July. On 22nd July, a multi-agency operation was launched to prevent rising flood water from overwhelming Walham electricity substation
– a site of critical national importance. The response involved hundreds of personnel from a number of organisations, including the Fire and Rescue services, Environment Agency and several military establishments; despite the very short notice and facing a number of challenges during the response, the various agencies were able to coordinate an effective response and prevent the flood water from forcing the shut down of the substation.

2.3.2 Maritime lifeboat rescue

At 0045 on 6 June 2006, a deckhand on board the UK-registered scallop dredger *Danielle* became trapped by a rope that was being used on a winch-whipping drum. He sustained serious arm and chest injuries and was evacuated by RNLI lifeboat and ambulance to hospital, where subsequently his arm had to be amputated. Of particular interest to this report, is the question of whether or not to scramble a rescue helicopter (which could have delivered the injured man to hospital more quickly than the lifeboat and ambulance used), and the manner in which the different agencies involved in Air-Sea rescue interact and coordinate their activities.

2.3.3 Coastal town flood

On Monday 16th August 2004, there was exceptionally heavy rainfall within a concentrated area of Cornwall for several hours. Boscastle lies in a deep coomb formed by two river valleys (the rivers Valency and Jordan, with a third river, Paradise, joining them near the village) and during the rains, these rivers, which run through the centre of the village, overflowed, trapping residents and washing cars out into the sea. The village is a popular tourist destination and about 1,000 residents and holidaymakers were thought to have been at risk. A major Search and Rescue operation was launched, including resources from the emergency services, Her Majesty’s Coastguard, the Royal National Lifeboat Institute (RNLI), the Royal Air Force (RAF) and the Environment Agency. There were seven rescue helicopters scrambled and around 60 people were rescued. The rapid response by the emergency services helped ensure that there were no fatalities.

2.4 Rationale

As has been discussed earlier in this report, studies of multi-agency operations are highly relevant to current and future operations undertaken by UK armed forces. Whilst the scenarios used in this report are ‘civil’, they possess a number of features that make them appropriate for study. Civil emergency response situations can be considered analogous to military operations, due to their large scale, level of complexity, high tempo and requirement for coordination across agencies. In addition, as was the case in these scenarios, the military can be called upon to assist during civilian emergencies under what is known as Military Aid to the Civil Authorities - MACA (see Section 2.4.3) - or can be involved in Air-Sea rescue operations. MACA not only requires an understanding of civilian command structures and procedures, but may also provide an indication of some of the issues that the military are likely to face when dealing with civilian and non-governmental organisations during other ‘operations other than war’ situations. The
Strategic Defence Review – A New Chapter acknowledges these similarities and the requirement for military understanding of civilian organisations, saying that:

“Many of the skills required for the successful conduct of military operations are also applicable to civil crises. But, to participate effectively in civil emergencies, the Armed Forces also require some additional knowledge of civil structures and practices.” (MoD, 2002a, p26)

Civilian emergencies therefore present an opportunity to learn from existing multi-agency C2 and apply this to future military systems, adopting those aspects that work well and avoiding potential problems.

The scenarios selected for analysis in this report were recent, large-scale, complex emergencies, involving a variety of civilian Category 1 and 2 response organisations, as well as various military groups (the classification of civilian response organisations is described in Section 2.4.4). However, they also have relatively short timeframes and are straightforward enough to rapidly develop a basic understanding of, and to be able to make valid conclusions and generalisations to other multi-agency situations. The situations faced by the emergency services and other agencies required them to work closely towards a common goal, enabling an evaluation of the effectiveness of their coordination and cooperation to be made.

2.4.1 Phases of a Major Incident

Civilian Major Incidents can be separated into four main phases, which are shown on Figure 1 below. The four phases can be summarised as follows:

- **Initial Response**: The emergency services are notified of the incident, resources are dispatched and an assessment is made that this is a ‘Major Incident’.

- **Consolidation Phase**: Resources are in place on-scene and the emergency services, together with other agencies, concentrate on achieving their main goals for the incident (for example, life-saving operations and hazard neutralisation).

- **Recovery Phase**: Having completed their rescue activities and made the site safe, the emergency services scale down their activities; control of the incident site passes to the local authorities, who (along with other agencies) increase their activities, such as care of the homeless and clearance of debris.

- **Restoration of normality**: Activities designed to produce a rapid return to a state of normality are undertaken, for example property repairs and re-opening of normal traffic routes.

An additional activity that may be undertaken by the Police and other agencies during and after the incident has been resolved is an investigation of the circumstances surrounding the emergency.

Some of the issues associated with command and control during the initial stages of multi-agency operations were highlighted in our earlier report “Analysis of Multi Agency
Intent” (McMaster, Baber & Houghton, 2007). The current report looks at major incident scenarios during the later consolidation phase – where the responding agencies implement their solution to the situation, enabling us to develop a wider understanding of the issues relating to command intent during multi-agency operations across the phases of Major Incident responses.

![Figure 1 - The Phases of a Major Incident](image)

### 2.4.2 Features of multi-agency Major Incidents

The principle reason for the requirement for multiple agencies to attend an incident is that no single agency has the expertise or the equipment to implement a fast and appropriate response single-handedly. Whilst personnel from each emergency service are trained to deal with a variety of emergency situations, each service specialises on a particular subset of the response, such as rescue (Fire and Rescue) or treatment of casualties (Ambulance Service). For that reason the specialist skills and training of several different agencies may be required at a Major Incident in order to rapidly resolve the problem.

Major Incidents have been characterised by their “un-ness”, i.e. they are unexpected, unplanned for and unprecedented (Crichton, 2003). As a result, one of the defining features of Major Incidents is the high level of uncertainty surrounding the situation; this can include uncertainty about a number of factors, such as:

1. The nature of the incident (e.g. fire, explosion, crash);
2. Details of the incident (e.g. location, numbers of casualties, access);
3. Cause of the incident (e.g. gas leak, black ice, terrorist attack);
4. The quality of the incident information (i.e. source, relevance, accuracy);
5. Appropriate response (both goals and tactics).

Previous research indicates that in the initial stages of a large and complex incident, it is unlikely that any single individual or organisation will be in possession of all of the information to fully understand the problem and formulate a solution – various organisations will be in possession of ‘pieces’ of the puzzle (McMaster, Baber and Houghton, 2007). Uncertainty surrounding the first three factors listed above can be reduced through the rapid collection, analysis and dissemination of incident information across agencies and levels of command.

Additionally, given the unique nature of every Major Incident, it can be hard for commanders to identify and separate out the critical elements of this situation from the non-relevant information. This concerns objective aspects of the information presented during an incident, i.e. the relevance, accuracy and timeliness of the information, but it also relates to subjective evaluations, such as the level of confidence in the source of the information.

There is also a degree of uncertainty surrounding the best course of action for the responding agencies to follow, due to the novelty of the situation and their incomplete picture of it; as a result, commanders are required to engage in cognitively effortful and subsequently error-prone problem solving.

### 2.4.3 Military Aid to Civil Authorities

Following the terrorist attacks in the United States on 11th September 2001, the ‘Strategic Defence Review: A New Chapter’ was published, which in part sought to enable a better integrated military focus during terrorist attacks and other civil emergencies (MoD, 2002a). Military Aid to Civil Authorities (MACA) is the name for emergency military support within the UK and forms part of the wider ‘Defence Contribution to Resilience’ (MoD, 2002b).

Whilst the military would undoubtedly be able to provide considerable assistance to the emergency services and other government agencies on a regular basis, use of the armed forces is strictly limited to only the most exceptional circumstances, where civil capability or capacity has been exceeded and where there is likely to be a detrimental effect on human welfare (MoD, 2002b; Highways Agency, 2008). To ensure this is the case, restrictions are placed on the deployment of military resources:

- Military assistance is to be provided at the request of the civil authorities and only in relation to a specific planned response or crisis;
- Military aid should only be used as a last resort and only in cases where the civil authority lacks the required capability, or there are insufficient resources available for an urgent situation;
- Unless there are exceptional circumstances, deployment requires the approval of a defence minister;
- During the provision of military assistance, the civil authorities have primacy;
Military forces are subject to both civil and military law (MoD, 2002b). Though use of the military is restricted, they may still be called upon to deal with a wide range of situations including natural disasters, terrorism or outbreaks of disease; these very different scenarios require the military to be ready to perform a wide range of tasks at very short notice, in order to augment civil authorities and close the capability gap.

2.4.4 Civil Contingencies Act 2004

The 2004 Civil Contingencies Act defined an emergency as an event or situation that threatens serious damage to human welfare, or to the environment or (in the case of war or terrorism) to security. Part 1 of the Act, which focuses on local response to emergencies, divides responders into two categories (Category 1 and Category 2). Category 1 responders will assess local risks and develop emergency plans, business continuity management arrangements, and processes for information management and dissemination, as well as undertaking the main activities in the response. Category 1 responders are shown in Table 1.

Table 1 - Category 1 (“core”) responders as identified within the Civil Contingencies Act (2004)

<table>
<thead>
<tr>
<th>Emergency Services</th>
<th>Health Bodies</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Police Forces (including Northern Ireland)</td>
<td>• Primary Care Trusts</td>
</tr>
<tr>
<td>• British Transport Police</td>
<td>• Health Protection Agency</td>
</tr>
<tr>
<td>• Fire Authorities</td>
<td>• NHS Acute Trusts</td>
</tr>
<tr>
<td>• Ambulance Services</td>
<td>• Foundation Trusts</td>
</tr>
<tr>
<td></td>
<td>• Local Health Boards (Wales, Scotland)</td>
</tr>
<tr>
<td></td>
<td>• Port Health Authorities</td>
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</tbody>
</table>

Local Authorities

<table>
<thead>
<tr>
<th>Government Agencies</th>
</tr>
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<tbody>
<tr>
<td>• Local Authorities</td>
</tr>
<tr>
<td>• Port Health Authorities</td>
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<tr>
<td>• Local Health Boards (Wales, Scotland)</td>
</tr>
<tr>
<td>• Port Health Authorities</td>
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</table>

Category 2 responders include: all of the major utilities (i.e., electricity, gas, water and sewerage, telecommunications); all major transport authorities and operators (i.e., rail, highways, airports, harbours, etc.); strategic health authorities and the Health and Safety Executive.
Responsibility for planning and coordinating emergency response can be assumed by either the emergency services (under its existing command structure of Gold, Silver, Bronze response) or by a Local Resilience Forum (LRF).

The Civil Contingencies Act (2004) outlines the processes of Integrated Emergency Management (IEM) as follows:

- **Anticipate** – ‘horizon scanning’ and associated forecasting activities to enable planners to know what might happen and how events might develop;

- **Assess** – development and maintenance of ‘risk registers’ to enable planners to appreciate the likely severity and consequences of hazards and their possible spread and development;

- **Prevent** – implement measures to reduce or remove the anticipated risks, e.g., through the introduction of flood management;

- **Prepare** – develop procedures that enable efficient operational response, probably with more than one emergency service, and train these joint procedures;

- **Recover** – after the incident has been ‘closed’ by the emergency services, there remains activities associated with clean-up, decontamination, reconstruction of the site, together with medical and counselling aid to victims, and associated legal and insurance procedures.

These processes are related to the phases of an incident outlined in section 2.4.1, and are supported by eight guiding principles for emergency response:

- **Direction** – clarity of purpose defined by a strategic aim and objectives. This is akin to the notion of Command Intent being explored in this work package.

- **Integration** – effective and efficient coordination between agencies involved in the response.

- **Subsidiarity** – coordination occurs at the lowest appropriate level.

- **Preparedness** – all agencies, and their members, have clear understanding of their role and appropriate knowledge and abilities to undertake these roles.

- **Continuity** – organisations should be able to employ Standard Operating Procedures such that their response to the emergency involves well-drilled activities, albeit at a greater tempo.

- **Communication** – reliable information is passed as efficiently as possible to all agencies who need it, including the public.

- **Cooperation** – agencies cooperate in a spirit of mutual trust and understanding.
• Anticipation – risk assessment and identification is performed in an ongoing manner in order to ascertain any possible changes in level of risk so that the response can be managed as appropriately and flexibly as possible.

2.5 Report objectives

The purpose of this report is to present our findings relating to coordination and Command Intent during multi-agency operations; we specifically examined three issues:

• How does the context of the situation force responding agencies away from formal structures and procedures?

• How is Command Intent managed across ad hoc and fragmented systems?

• How could technology be used to support multi-agency operations?

In order to explore these issues, four aspects of multi-agency command and control were examined:

• The formulation and communication of Command Intent;

• The Organisation Structures used to share information and coordinate activity within and across agencies;

• Inter-agency Cooperation during the incident response;

• The development and maintenance of Shared Awareness within and across agencies.

2.6 Approach

2.6.1 Gloucestershire floods and Walham substation

Our earlier report (for Work Package 3.1.4) focused on multi-agency coordination during the initial phase of the response to the terrorist attacks in London on 7th July 2005 and concentrated on the Gold and Silver levels of the emergency services command structures. The analysis of this scenario examines aspects of both the initial response and consolidation phases and is mainly concerned with the coordination of the response at the scene of the incident, i.e. the Bronze level of command.

Whilst a large number of organisations were actively involved in the response to the flooding of Walham substation, we have concentrated our analysis on the main agencies involved in the construction of the flood defences and removal of water from the site. Discussions and in-depth interviews (totalling over 7 hours) were held with 6 people from the agencies that were directly involved in the Walham substation incident. These interviews featured the use of the revised Critical Decision Method (CDM) probes developed by O’Hare et al. (2000) to identify key decision points during the emergency
and to explore decision making during a multi-agency incident. The interviewees are listed in Table 2, below.

<table>
<thead>
<tr>
<th>Agency</th>
<th>Role</th>
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<tbody>
<tr>
<td>Avon Fire and Rescue Service</td>
<td>Incident Commander – ‘Bronze’ (during the Consolidation Phase)</td>
</tr>
<tr>
<td>Gloucestershire Fire and Rescue Service</td>
<td>Deputy Chief Fire Officer – ‘Gold Liaison’</td>
</tr>
<tr>
<td>43 (Wessex) Brigade</td>
<td>Joint Regional Liaison Officer</td>
</tr>
<tr>
<td></td>
<td>Walham Site Liaison Officer (Brigade Reinforcement Team)</td>
</tr>
<tr>
<td>Environment Agency</td>
<td>Team Leader (Operations Delivery)</td>
</tr>
<tr>
<td></td>
<td>Specialist Team Member (Operations Delivery)</td>
</tr>
</tbody>
</table>

The interviewees selected were all closely involved in the planning and execution of the incident response and were able to provide detailed descriptions of events, command structures, decision-making, cooperation and the problems experienced during the defence of the substation. This information was used to build the timeline of events described in Section 3, as well as forming the basis of the analyses detailed in Sections 4 - 7.

2.6.2 Maritime lifeboat rescue

Search and Rescue literature and interviews with Subject Matter Experts have been used to investigate the organisation of Search and Rescue (SaR) activities. Firstly, a review of publicly available literature enabled the production of a standard Search and Rescue process; Search and Rescue procedures were then used to generate a social network diagram for mountain rescue operations. A report of a real maritime emergency and lifeboat rescue incident was also used to generate a social network diagram for maritime operations. These social network analyses were then discussed in relation to multi-agency Command Intent and Situation Awareness.

2.6.3 Coastal town flood

Publicly available reports and press releases on the flooding of the town of Boscastle on 16th August 2004 were used to construct a realistic narrative description and timeline for
a coastal flood scenario. The scenario was then used to identify implications for Command Intent and Situation Awareness from a multi-agency perspective.
3 Gloucestershire Floods and the Walham Substation

3.1 Background

The summer of 2007 saw widespread flooding in several regions of UK; one of the worst affected areas was Gloucestershire, with widespread flooding across the county. In addition to the extensive water damage caused to residential properties, travel became difficult and as roads and towns flooded, many people became trapped in their homes. Fresh water supplies to an estimated 350,000 people were disrupted for over a fortnight when Mythe water treatment plant was forced to shut down (BBC, 2007). Electricity to around 50,000 properties was temporarily disrupted and over 500,000 homes were at risk of spending an extended period without electricity as both the Walham and Castlemeads substations were threatened by rising floodwater (Elliott and Brown, 2007).

By the early hours of Sunday 22nd July, it became apparent that fluvial (river) flooding would pose an even greater problem, as the flood levels of the Severn and other rivers rose with the increased rainfall runoff from surrounding counties that fed into them. Mythe water treatment plant was shut down and massive flooding across Gloucestershire looked likely.

The formal request for military assistance to the emergency services to tackle the floods was made to on Sunday 22nd July, as it became apparent that the flooding was set to worsen. 43 (Wessex) Brigade are non-deployable (i.e. do not perform operations overseas) – their role is to provide administration, infrastructure and logistics support to the Army units in the South West region. In addition, they coordinate UK operations within the South West region, including Gloucestershire. The military response to the flooding was codenamed Operation Giraffe (Operation Outlook was the name used for the wider emergency service response). The operation lasted until 30th July, when the emergency services were able to manage the incident without military assistance.

3.1.1 Operation Giraffe – Overview

Military engagement was requested by Gloucestershire Constabulary on the afternoon of Friday 20th July, initially in the form of Search and Rescue operations (Search and Rescue is a standing task for the military outside of MACA restrictions). Regional Liaison Officers for 43 (Wessex) Brigade went to Gold Command at Gloucestershire Police Headquarters and the first Strategic Coordination Group meeting took place that evening. The Joint Regional Liaison Officer (JRLO) kept his Commanding Officer (Brigadier) briefed on events. Whilst there were occasional requests for specific military resources that night, such as 4x4 vehicles (which the military did not supply, as this did not fall within the MACA remit), it did not appear that there would be a requirement for military involvement.

River level forecasts for Saturday were upbeat; however, by Sunday morning, Mythe water treatment plant had flooded and it became apparent that wide areas of
Gloucestershire would be affected by flooding. The formal request for military assistance was made at midday. The Police MACA request (as discussed at Gold meeting No.9) summarised the tasks for which military capability was required as being:

- Distribution of life saving water;
- Engineering capability;
- Helicopter support for reconnaissance;
- Evacuation of vulnerable people.

These tasks were required in order to obtain the required effect (i.e. to save lives, alleviate distress and protect property).

The Joint Regional Liaison Officer had already warned the Standing Joint Commander (UK) that such a request was likely; military assistance was given approval and the operation to support civilian authorities in Gloucester was known as Operation Giraffe.

Resources from all three armed services began arriving in Gloucestershire later that day and initiated activities to support the emergency services; approximately 1,000 military personnel were deployed across the county in flood response work, including: continued Search and Rescue operations, construction of flood defences, distribution of bottled drinking water and logistics support for bulk water distribution.

By Monday 30th July, electricity supplies to the region were secure, water supplies to homes were being reinstated and the emergency services no longer required military support. Military personnel were withdrawn, having:

- Engaged in around 70 Search and Rescue sorties (along with Coast Guard helicopters) – airlifting approximately 200 people to safety;
- Assisted in the protection of electricity supplies to several million people in England and Wales;
- Distributed approximately 3 million litres of bottled water per day to people without fresh water supplies;
- Developed the logistics plan to enable 3-5 refills a day of 1,400 water bowsers.

### 3.2 Walham substation

One of the sites identified as being at serious risk of flooding was Walham electricity substation. Walham supplies electricity to around 500,000 homes (approx. 2,000,000 people) in England and Wales; it was also reported to provide electricity to Government Communications Headquarters (GCHQ) and a nuclear establishment (Snow and Manning, 2007) – all of which would be left without electricity for a prolonged period if the substation were to flood. Walham was therefore considered to be critical national infrastructure. On Sunday (22nd July), rising flood levels were predicted to peak at a
height that would put the substation out of commission; it was therefore decided that every effort should be made to prevent it from flooding. The operation to prevent Walham substation from flooding took place over Sunday night, with high water expected at around 03:30. The plan of action was to construct a series of flood defences around the critical switching room, which included the use of sandbag barriers, the Environment Agency barrier and specialist pumping equipment, in order to keep the level of the floodwater down through high tide and enable the substation to remain live.

3.3 Walham incident timeline

Below is a timeline of the main events relating to the establishment of the flood response at Walham substation during the Consolidation Phase - the site had already been identified as being of critical importance and a response was under way; however, the appropriate resources were not yet in place to deal with the situation. Approximate times are given where available. It should be noted that this timeline is provided merely to give an overview of the incident and to illustrate the short time frame, particularly considering that the military resources sent to the site would have had no advance warning of their potential role. Several other agencies were involved in the incident response and played important roles in enabling the successful outcome, though their actions are not mentioned here.

3.3.1 Sunday 22nd July

Early Morning: The Strategic Coordination Group at Gold Command was notified that due to rising river levels, massive flooding across Gloucestershire was likely; emergency services resources had already been severely overstretched during the response to the pluvial (surface water) flooding on Friday and Saturday. Along with other resources, members of 43 Brigade Readiness Team were requested to mobilise to Gloucestershire Constabulary Headquarters (in anticipation of a formal request for military assistance). One of the sites identified as being at risk from rising flood water was Walham substation; this was the first time that Gold Command were made aware of the potential for Walham to flood, or of the extensive consequences should it be forced to shut down. Gold Command took the decision to deploy barriers and pumps to try to protect the substation (Gloucestershire Constabulary, 2007).

12:00: Military assistance to the county-wide flooding problems was formally requested by Gloucestershire Constabulary. The request was made to the Deputy Joint Regional Liaison Officer (JRLO). The Joint Regional Liaison Officer had already warned Standing Joint Commander (SJC): UK that this request was imminent. Whilst resources were being located and notified (by SJC staff), additional 43 (Wessex) Brigade personnel moved to Gold Command and began to plan for the tasks that they had been requested to assist with.

16:00: The Environment Agency regional Operations Delivery Manager was contacted by Gold Command and briefed on the situation at Walham; they were asked if their specialist flood defences could be used to protect the substation. A member of the Operations Delivery Team went to the site, met with the Fire Incident Commander and performed an initial assessment. The Operations Delivery Specialist determined that the
Environment Agency flood barrier could be used, though it would be difficult to construct the barrier in the time available. The regional Operations Delivery Manager was briefed by phone and barrier components from several locations were deployed, along with other equipment. Two Environment Agency Operations Delivery teams were mobilised and briefed at their depots.

17:30: A contingent of Fire and Rescue appliances and personnel was sent from Avon to assist with the flood response in Gloucestershire, including the Walham substation defence. Equipment sent to the site included specialist High Volume Pumps (HVPs), to drain flood water from the substation.

18:00: One of the Brigade Readiness Team who arrived at Gold Command was briefed by Deputy JRLO, before proceeding to Walham to act as military Liaison Officer.

18:30: The Liaison Officer arrived at Walham. A group coming from RAF Cosford were to be dropped by Chinook helicopter. The Liaison Officer met with the Fire and Rescue Incident Commander, then surveyed the area for appropriate landing sites. The two Environment Agency Operations Delivery teams arrived on site. They were briefed by the National Grid Electrical Site Controller as to where and how they would be able to work on site safely.

19:30: Avon Fire and Rescue resources arrived at Walham. An Officer from Avon Fire and Rescue was designated Incident Commander and was briefed by the previous Commander. A team from RAF Innsworth under the command of a Squadron Leader arrived on site and reported directly to the Fire and Rescue Incident Commander.

20:30: The Environment Agency flood defence equipment began to arrive and the Environment Agency teams started work on the barrier.

21:30: The Chinook Pilot reconnoitred the landing sites, selected one and dropped off the RAF Cosford personnel (commanded by a Squadron Leader). The Liaison Officer briefed the RAF teams; they were then put to work sandbagging and moving flood defence components into place. Later, personnel from RAF Lynham arrived on site, were briefed by the Liaison Officer and began work on the flood defences.

3.3.2 Monday 23rd July

~02:40: One of the Environment Agency Team members reported that they thought the barrier was sealed.

~02:50: The Fire and Rescue Incident Commander reported that the water level inside the barrier was starting to drop, indicating that the pumps were draining the site faster than the floodwater was entering it. The flood water in the main switching room reportedly came to within 2 inches of the height at which the substation would have to be shut down (Snow and Manning, 2007). All non-essential personnel were withdrawn from the site before high tide (the lower part of the River Severn is affected by tidal surges); high tide came without the water reaching the level of the flood defences; the water level outside the flood defences began to recede, which meant that the flood defences had held.
3.4 Incident site features

The timeline above shows that the responding agencies faced severe time pressures to complete the barrier before high tide (which otherwise would have forced the substation to be shut down). In addition to this, other characteristics of the site and the wider environment created difficulties for the incident response:

- Most of the work to construct the flood defences and pump water out of the site took place overnight. The site would have been very noisy, due to the vehicles and pumping equipment. Numerous Fire and Rescue appliances, including 8 specialist High Volume Pumps, were used to drain water out of the site.

- Whilst the floodwater was not very deep or fast flowing, it still presented a drowning hazard to the personnel on-site. As high tide grew nearer, there were concerns that the rising tide would suddenly overwhelm the defences and inundate the substation, requiring all non-essential personnel to be withdrawn.

- Access to the incident site was limited, firstly due to extensive flooding in the surrounding area (as can be seen in Figure 4) and across the county, causing delays to vehicles trying to reach the site. A single road leads to the site entrance and was not flooded, but access along the road was reduced to a single lane, due to the emergency service vehicles, which were double-parked along the road. There was a large volume of traffic onto and off the site, including large articulated lorries delivering the Environment Agency dam components and Fire and Rescue pumping equipment.

- As the substation was live throughout the incident, the risk of arcing electricity placed restrictions on the use of forklift trucks to move the dam components around parts of the site, limiting the room available for forklifts to unload the lorries and necessitating manual lifting to bring components into place. A National Grid escort was required to enter the main switching room area, because of the risk of electrocution.

- Some parts of the site where the Environment Agency barrier was to be built were already underwater and the layout of the substation and surrounding buildings restricted the space available to deploy the flood defences.

Figure 2 and Figure 4 below are aerial photographs of Walham substation taken during the days following the emergency work to protect it from flooding; the Environment Agency barrier can be seen, along with the extensive flooding to the surrounding countryside.

Figure 2 - Aerial photograph of Walham substation. The photograph shows the Environment Agency barrier (the light blue ring) in place around the substation and the flooded fields surrounding the site – Picture removed due to copyright
3.5 Agencies, roles and responsibilities

**Fire and Rescue Services:** Both Avon and Gloucestershire Fire and Rescue Services were involved in the incident response – Avon Fire and Rescue were providing assistance to Gloucestershire through their mutual aid agreement. The fire services were responsible for the incident site, with the Fire Bronze commander having overall command of all of the responding agencies. The fire service coordinated the activity of the different organisations, controlled access to the site and was responsible for the safety of all personnel within the inner cordon. In addition, fire service equipment and personnel were involved in building sandbag protection for substation facilities and in pumping water out of the site. The fire service controlled media access to the site and gave press releases and briefings as the incident progressed.

**Police:** Gloucestershire Police force was the lead organisation during the response to the county-wide flooding emergency. Gold Command was situated at Gloucestershire Police headquarters, where representatives from the other responding agencies were represented in the Strategic Coordination Group. Gloucestershire Police took the decision to formally request military assistance in response to the widespread flooding, and though the Police were involved in strategic decisions regarding the response to the Walham substation incident, they were not significantly involved in the response at the scene.

**Military:** Within Gold Command, the military were involved in strategic planning for the county-wide emergency and in detailed logistical planning for particular aspects of the response, including the distribution of bottled water and the refills of on-street water bowers. At Walham substation, initially teams of RAF personnel and later on units from all three services were present; their role was to support the emergency services and assist in flood defence construction.

**Environment Agency:** The Environment Agency worked with Gold Command, providing flood warnings and flood risk predictions and maps. The Environment Agency Operations Delivery teams were responsible for emergency flood defence work; on site at Walham, the Operations Delivery teams provided crucial flood defence equipment and expertise. The Environment Agency also proposed an interim flood defence solution for use at Walham substation and other ‘at risk’ sites, after their temporary barriers had been removed and before long-term flood defences could be built.
**National Grid:** During the efforts to prevent Walham substation flooding, National Grid personnel were involved in assessing the risk posed to personnel working on the site, defining safe working practices, escorting working parties into restricted areas and monitoring the depth of flood water in critical areas. They were responsible for deciding what depth of water would require the shutdown of the substation and defined restrictions on personnel working on the site to ensure that they were safe from electrocution.

**RNLI:** The Royal National Lifeboat Institute were on-scene during the construction of the flood defences. Using boats, they conducted floodwater risk assessments, measured depths at various points around the site and provided support to personnel working on the flood defences.

A Channel 4 News report (“Saving Walham Station”) shows the flood defences in detail and provides an overview of the incident response; it can be downloaded from: [http://www.channel4.com/player/v2/player.jsp?showId=7916](http://www.channel4.com/player/v2/player.jsp?showId=7916)
4 Organisational Structures

4.1 Overall Organisational Structures

The organisation of the emergency services during major incidents and the use of the Gold, Silver, Bronze command hierarchy has been discussed in other reports (c.f. McMaster et al., 2007); however there are some features of the organisational structures adopted during this incident which should be mentioned (the Bronze level of command is discussed in Section 4.2).

4.1.1 Gold (Strategic) Control

Gloucestershire Constabulary had primacy over the county-wide emergency and primarily took a coordinating role in the response; the position of Gold Commander was taken by an Assistant Chief Constable. The Police chaired the Strategic Coordination Group, which was made up of representatives from the Category 1 and 2 response organisations involved in the emergency (i.e., emergency services, health authorities, Environment Agency, utilities companies, military involvement, etc.). Gold Command is a purpose-built facility within Gloucestershire Constabulary Headquarters; it features the Strategic Coordination Centre - an open-plan office space with information technology (IT), communications facilities and meeting rooms for use by all of the representatives from the various agencies involved in the emergency response. This office space is adjacent to the Gold Command Room (Gloucestershire Constabulary, 2007).

4.1.2 Silver (Tactical) Command

Gloucestershire Constabulary Headquarters is located on the same site as the Gloucestershire TriService Emergency Centre (GTEC), a single facility which houses the Police, Fire and Rescue and Ambulance control rooms (Gloucestershire Constabulary, 2007). Silver Command for the emergency was set up in a purpose-built facility within GTEC.

4.1.3 Platinum Command

Due to the scale and complexity of the emergency situation, the Chief Constable felt that it was necessary to take overall responsibility for the emergency response through the role of Platinum Commander, i.e. above Gold Command (Gloucestershire Constabulary, 2007). As Platinum Commander, the Chief Constable liaised with COBR (Cabinet Office Briefing Room – also referred to as COBRA), which had been activated in response to the floods in July and who were particularly concerned with the protection of Walham substation, due to the national impact of the site (The Pitt Review, 2008). The Chief Constable also held daily briefings for the press, which played an important role in reassuring the public that the situation was being dealt with and when they could expect services (such as drinking water) to return to normal.
4.1.4 Military

Whilst 43 (Wessex) Brigade have responsibility during MACA operations within the South West, the Brigadier does not command any of the armed forces units within the region (he commands the Territorial Army in the South West, but the Territorial Army would need to be mobilised before being able to support UK operations). When a civil authority makes a request for assistance, it is passed to the Standing Joint Commander – UK, who decides what level of response should be provided and finds the resources to be used. In the event, personnel from all three armed services were involved in the flood responses; each unit was put under the tactical command of the Brigadier on arrival in the county and remained so for the duration of their involvement in the operation. Either the Brigadier or his representatives were part of the Strategic Coordination Group throughout the emergency and all military activity operated under the command and control of Gold Command (Gloucestershire Constabulary, 2007).

43 Brigade ran the military involvement in Operation Outlook almost entirely from Gold Command at Police Headquarters, where they had a number of teams working on the various tasks they had been asked to assist with, such as logistical planning for bottled and bulk water distribution throughout the county. Military personnel were provided with office space within the Strategic Coordination Centre, including dedicated computer equipment and communications facilities.

Within Gold Command, Liaison Officers were used extensively, to coordinate military activity with partner organisations and to ensure that the military commander was kept appraised of the situation on the ground and vice versa (the role of military Liaison Officers is discussed further in Section 7).

4.1.5 Fire and Rescue Service

The Fire and Rescue response to the flooding emergency was organised according to the Gold, Silver, Bronze command structure, which is common to all three ‘blue light’ emergency services during a Major Incident; the Fire and Rescue ‘Gold’ Commander coordinated the strategic response from Gold Command within Gloucestershire Constabulary headquarters. However, due to the scale of the emergency, Gloucestershire Fire and Rescue drew support from neighbouring services under the Mutual Aid scheme; support was provided in a number of ways:

- As the number of emergency incidents rose, Gloucestershire Fire and Rescue service received much greater call volumes than they would normally anticipate. In order to maintain prompt responses to priority calls for emergency assistance and to ensure that no calls were lost, 999 calls were re-directed to services in neighbouring regions (for example, Avon or West Midlands) if Gloucestershire Fire Control did not answer them within a minimum time. These calls were evaluated and prioritised, before the details were faxed back to Gloucestershire Fire and Rescue, who were then able to concentrate on the most urgent incidents.
• Additional resources from surrounding brigades were brought in to assist with the flood response, including Avon Fire and Rescue Service; these crews and pumps were managed by their own service’s control centres, who then liaised with Gloucestershire Fire and Rescue Control.

• Specialist resources, such as the High Volume Pumps that were used at Walham substation on the Sunday night, were brought in from around the country.

The overall Fire and Rescue Command structure in relation to the response to the Walham substation flooding is shown in Figure 5, with lines of communication shown by the blue arrows. The diagram shows the role played by Avon and Gloucestershire Fire and Rescue services in the Command and Control of the Walham incident. Normally, Bronze Command would be directed by Gloucestershire Command structure – however, Avon Fire Service Control took over the incident at Walham from a resource perspective, as many of the personnel on site (including the Bronze Commander) were from Avon Fire and Rescue Service. Avon Fire and Rescue Service were also responsible for organising relief crews to take over from personnel at the site.

The Deputy Chief Fire Officer (DCFO) from Gloucestershire Fire and Rescue service also played a non-standard role in the incident response, as he was on site at Walham, acting as ‘Gold Liaison’. The DCFO was ‘hands off’, i.e. he was not directly involved in the command of the incident response, leaving that to the Bronze Commander; however, he provided direct input to Gold Command on the progress of the response to the emergency situation, managed media interest at the site and provided advice and support in solving problems that the Bronze Commander experienced.

The use of Fire and Rescue equipment to pump water is dependent on a supply of diesel to fuel the generators; as a result of the number of separate incidents being dealt with across Gloucestershire and the number of Fire and Rescue resources involved, a separate command point was set up, specifically to deal with refuelling requirements – this was called ‘Pseudo Silver’. As a result of the ad hoc command structure, with the roles played by Avon Fire and Rescue Service, ‘Gold Liaison’ and ‘Pseudo Silver’, the Bronze Commander did not communicate directly with Silver Command.

Figure 5 was created from the perspective of the Bronze Commander, so whilst there may have been additional lines of communication across the various levels of command, the Bronze Commander was not aware of them at the time; for example, it is likely that the Gold Fire Group within Avon Fire and Rescue Service was in contact with Gold Command at Gloucestershire Constabulary headquarters. Dashed lines on Figure 5 indicate these likely additional lines of communication.
Figure 5 - Fire and Rescue Major Incident command structure adopted during the response to the flooding of Walham electricity substation

4.1.6 Environment Agency

The Operations Delivery Manager for the Midlands Region was not in Gold Command during the construction of defences for Walham substation; instead, he was in the Environment Agency incident room in Shrewsbury. The reason for this is that the Environment Agency ‘Midlands Region’ covers a large area, from Gloucester across to Coventry and as far north as Derby and parts of the Peak District (Environment Agency, 2008). Flooding occurred across a number of areas within this region, resulting in emergency work for Environment Agency teams outside of Gloucestershire.
4.2 On Site Organisational Structures

4.2.1 Fire and Rescue Service

The Fire and Rescue Bronze Commander had overall responsibility for personnel across all agencies working on site at Walham substation. The Bronze Commander was in charge of the incident response and also took final decisions regarding site safety and the need to evacuate personnel, were the situation to warrant it.

During a Major Incident, the Fire Bronze Commander would normally be supported in their role by the use of a command vehicle, featuring staff and associated IT infrastructure. Unfortunately, a command vehicle was not deployed at Walham during the initial response and the restricted road space on site meant that there was no room for one by the time the Avon Fire and Rescue Bronze Commander took command. As a result, the level of command support available to the Commander was severely limited and he was forced to run the incident from the back of his vehicle, using a pen, paper and a mobile phone.

Figure 6 shows the Fire command structure used on site during the incident response. The command structure contained all of the standard components from the incident command model, with the inner cordon divided into sectors, each of which had it’s own Sector Commander; however, upon taking command at the substation, the Bronze Commander decided that in order to manage the site effectively, it would be necessary to adapt the standard command structure by having two Operations Commanders. This was felt to be necessary, in order to manage the scene effectively; there were two very different sides to the site – the ‘dry’ side (consisting of the un-flooded areas and the High Volume Pumps) and the ‘wet’ side (including the flooded buildings, main switching area and switching room) and visibility and access between the two parts of the site was restricted.

Command during a Major Incident is defined by role, rather than seniority; in this instance, the Bronze Commander was outranked by both the Operations Commanders and the High Volume Pump specialists.
4.2.2 Military

The Commanding Officers of the units sent to Walham substation were briefed to provide the maximum support to the Bronze Commander - within their abilities and whilst taking into consideration the safety of personnel. The RAF teams organised themselves to create a single chain of command for military resources working on site. They then worked under the direction of the Bronze Commander, through the mediation of the Military Liaison Officer. The military units remained under the command of the Brigadier throughout their involvement in the incident; thus, the Bronze Commander did not have direct command over the military units, though the military acknowledged all of his requests for assistance.

4.2.3 Environment Agency

The Environment Agency had a very simple command structure; they had approximately 20 people on site, split into two teams, which worked on different sections of the barrier. One Operations Delivery Team Leader remained outside of the flooded part of the site, near to Bronze Command to liaise with the Fire and Rescue Service and the Military Liaison Officer, and in order to coordinate the movement of trucks bringing in barrier components. Groups from the three RAF teams were assigned to the two Environment
Agency teams and worked under their direction, moving barrier components into position.

4.3 Lines of communication within/across agencies

4.3.1 Fire and Rescue Service

As was previously mentioned, the Bronze Commander was in communication with Pseudo Silver and the Avon Gold Fire Group (this was via mobile phone). The Bronze Commander was indirectly in communication with Gloucestershire Gold Command through ‘Gold Liaison’ in the form of the DCFO who was on site. Communications within the on site command structure were carried out through face to face discussions and a single channel on Fire and Rescue Service analogue radios; the Bronze Commander was in regular contact with the Operations Commanders over the radio (Figure 7).

The Bronze Commander needed to maintain close contact with some of the other agencies working on site, namely the military, RNLI and Fire High Volume Pump specialists; representatives from these agencies therefore remained at the Bronze Command point throughout the incident response. Representatives from other agencies, including the Environment Agency, were nearby, but not in contact unless their input was required, though the level of contact between the different agencies changed over the course of the incident (c.f. Section 6).
Figure 7 - Inner cordon and Fire and Rescue communications at Walham substation

IC  Incident Commander  CS  Command Support
OC  Operations Commander  SC  Sector Commander
SO  Safety Officer
4.3.2 Military

The Liaison Officer remained with the Bronze Commander throughout the incident, gathering information, providing briefings and updates to the Commanding Officers from the RAF teams, as well as passing requests for assistance to them from the Bronze Commander. The Liaison Officer also provided situation reports every 10-15 minutes to the military representatives within Gold Command. The Liaison Officer had no direct communications with Gold Command, until he returned to Gloucestershire Constabulary headquarters and obtained an Airwave digital radio handset. Prior to this, all communications with Gold Command were through the use of mobile phones, as Brigade Readiness Teams have not been issued with Airwave handsets.

The Liaison Officer also needed to contact the pilot of the Chinook helicopter that was bringing the team from RAF Cosford; the original landing site suggested by the Police was found to be flooded, as was much of the surrounding area, which also featured numerous cables, pylons and other hazards. The Liaison Officer had identified two potential landing sites, but had no means of communicating with the pilot directly. The Liaison Officer spoke to the Deputy JRLO at Gold Command by mobile phone, who then spoke to the RAF Liaison Officer, who was able to get messages passed to the helicopter pilot. Once the RAF teams were working on flood defence construction, communication between the Liaison Officer and the various RAF Commanding Officers was done via messages passed through the Fire and Rescue radio system, as the military on site had no communications equipment of their own.

4.3.3 Environment Agency

The Environment Agency team leaders used their own walkie-talkies to communicate across the site and with the forklift truck drivers, to arrange where to drop off the barrier components. Mobile telephones were used to communicate off site with the Environment Agency incident room and to coordinate the lorry deliveries of barrier components onto the site, as they had no direct means of communicating with the lorry drivers, who were from an external contractor. Initially, the Environment Agency Team Manager did not have direct contact with the Bronze Commander, instead having to negotiate the Fire and Rescue chain of command in order to get a response to requests.

4.4 Discussion

Many of the issues examined in later sections of this report relate to the nature of the organisational structures in place during the incident response, so they are discussed throughout the report. However, there are two points that can be made now, based on what has been described in this section of the report. Both points had knock-on effects on the coordination of the multi-agency response, as will be shown in the following sections of the report.

1. Organisational structures may have to adapt to suit the emergency

   The constraints of the emergency situation may force commanders to adapt their organisations to better suit the environment in which they have to work, as is
demonstrated by the restructuring of Police, military and Fire and Rescue organisations at a number of different levels of command. Some of these changes were pre-arranged, including the provision of mutual aid between fire services, whilst others were ad hoc, such as the introduction of ‘Platinum’ and ‘Pseudo Silver’ levels of command, as well as the incident command arrangement between Gloucester and Avon Fire and Rescue services.

2. The co-dependency of organisations during the incident response is not reflected in the command structure

Whilst it is true that changes were made to the command structures in order to better fit them to the scale and nature of the emergency, below the Gold level the command structures are still essentially separate from each other, with separate lines of communication and no common technology platform. This arrangement does not reflect the co-dependency of cooperating organisations during multi-agency incident responses and appears to hinder efforts to dynamically reorganise lines of communication during an ongoing incident; illustrations of this include the difficulties faced by the Liaison Officer at Walham in contacting the Chinook pilot, the need for military resources at the incident site to ‘piggy-back’ on Fire and Rescue Service radio transmissions to communicate across the site and the failure to issue Brigade Readiness Team members with Airwave handsets, despite one of the intended benefits of the introduction of the Airwave digital radio network being to improve coordination between services in the event of civil emergencies (Airwave Solutions Limited, 2008). Whilst it is difficult to say exactly what the consequences of maintaining separate command structures during multi operations are, previous research (McMaster et al., 2007) suggests that this can delay the sharing of important incident information and the organisation of an appropriate response; as such, it is likely to have had a negative impact on Shared Awareness, Inter-Agency Cooperation and the formation and dissemination of Command Intent, which are discussed in the following sections of the report.
5 Shared Awareness

5.1 Introduction

Given the high levels of uncertainty associated with Major Incidents (as mentioned in Section 2) and the subsequent need to effectively share information between responding organisations, this report looks at how incident information and awareness of the situation was shared during this multi-agency operation, including how this was done within and across the agencies involved, and between levels of command.

5.1.1 Fire and Rescue - Major Incident command structure

Whilst there would undoubtedly have been different levels of awareness regarding detailed aspects of the incident response at different levels of the command hierarchy, the significant common element was the understanding that this site was of critical regional and national importance and that every effort should be made to prevent it from flooding. This strategic response originated from Gold Command and was briefed to the Bronze Commander upon his arrival at the incident site. However, the significance of Walham was not understood throughout the command structure. The fire appliances and High Volume Pumps, which were crucial in keeping down the level of the water within the substation, were run on diesel and refuelling was necessary in order to keep the pumps operating. The ad hoc control level of ‘Pseudo Silver’ was established in order to coordinate the refuelling of fire appliances operating across the county during the flooding emergency; when the Bronze Commander made requests for fuel to be sent to Walham, he was told that other incidents took priority and was not given an estimated time of arrival for the fuel. As a lack of diesel for the pump generators had the potential to lead to the substation flooding, the Bronze Commander was forced to request that Gold Liaison contact Pseudo Silver and use his authority within Gloucestershire Fire and Rescue service to ensure that fuel would be delivered in time. It would appear that Pseudo Silver Command considered Walham to be ‘one of many incidents’, rather than ‘the top priority incident’.

As was mentioned in Section 4, a senior Officer from Avon Fire and Rescue Service contacted the Bronze Commander during the incident; on hearing that there were two Operations Commanders, the senior Officer became concerned and wanted to discuss the matter with the Bronze Commander, who was extremely busy and did not have time for the interruption. This indicates a lack of awareness of the nature of the ongoing incident at higher levels of Avon Fire and Rescue command, which meant that the senior Officer did not have confidence in some of the Bronze Commander’s decisions. Again, this may have been hampered by the lack of a Command Vehicle at the scene, as Avon Fire and Rescue Command were dependent on the Bronze Commander for incident updates - which he was too busy to provide. Gloucestershire Gold Command had Gold Liaison on scene at Walham to provide regular updates and ‘reassurance’, so there was no need for Gloucestershire Gold or Silver Command to make contact with the Bronze Commander.
5.1.2 Fire and Rescue Bronze Commander

The Bronze Commander had a number of factors to take into consideration when planning and executing the incident response, in terms of both the defence of the substation and an ongoing risk assessment of the incident site. In planning the defence of the substation, the Bronze Commander was mainly concerned with the following aspects of the incident:

- Completion of the Environment Agency barrier before high tide;
- Rising floodwater levels and the risk this posed with the live substation;
- Sandbagging and drainage of the site with pumps;
- Effective management of site access;
- Availability and use of military resources;
- Availability of diesel for the pumps;
- Availability of aggregates for sandbagging.

The range of information drawn on during risk assessment included:

- The nature of the electrical hazard, as assessed by the National Grid Safety Officers;
- The nature of the flood hazard, as assessed by RNLI boat crews;
- Flood water depths in critical areas of the site (National Grid Safety Officers and RNLI);
- General site safety and emergency evacuation procedures.

Whilst the nature of the incident remained relatively static, the features of the emergency listed above were constantly changing, requiring reassessment of the viability of the overall response plan and the level of risk to personnel on the site. As was previously stated, no single aspect of the incident response was sufficient to protect the substation by itself; rather it was the combined efforts of the various aspects of the defences that prevented the floodwater from overwhelming the site. The Bronze Commander therefore spent much of his time in discussion with representatives of the Fire and Rescue Service and the other agencies involved in the response, in order to gather information on their particular aspect of the incident response and to ensure that his understanding of the state of the emergency was up to date.

Representatives from the other agencies involved therefore remained in close proximity to the Bronze Command point as the Bronze Commander needed to speak to them regularly. For example, the RNLI Liaison Officer provided regular updates on water depths and conditions around the site. Given the Bronze Commander’s concerns over the
depth of the water within key areas of the site (such as the switching room) he was also in constant contact with the Operations Commander (wet) and the High Volume Pump (HVP) Specialists; 8 HVPs were deployed at Walham that night, which had been brought in from around the country (and was one of the reasons for the large number of Fire appliances and trucks at the scene).

The Bronze Commander did not initially think that he needed to remain in close contact with the Environment Agency, as they knew what was required in order to construct their barrier. However, when it became evident that the Environment Agency were facing problems which risked the barrier not being constructed in time, the Bronze Commander liaised more closely with the Operations Delivery Team Leader and gave their activities top priority.

The Bronze Commander felt that the lack of an Incident Command Vehicle increased his workload, in terms of the inability to use support staff and equipment to collect and represent the various elements of the situation and the response plan (e.g. floodwater depths were written on piece of paper); a complete understanding of the whole situation was therefore only held by him and the response ‘plan’ was mostly in his head, so he was unable to delegate many tasks and was continually required to make decisions and give orders. The lack of an Incident Command Vehicle also impaired his ability to understand what Pseudo Silver was doing (i.e. if and when diesel would be sent to the site), as he did not have time to phone Pseudo Silver for updates and to argue his case.

The Bronze Commander commented that the Fire Service would normally seek to discuss the situation with partner organisations and seek agreement, prior to initiating the incident response; however, in this situation he simply did not have the time to do this and the constant requirement for command decisions meant that briefings and situation updates to other organisations were not carried out (c.f. Section 7 – Command Intent). Even within the Fire and Rescue Service, whilst the Operations and Sector Commanders had an overview of the situation and were aware of the Bronze Commander’s aims, the Bronze Commander did not have time to brief all of the fire crews in attendance about the situation and the significance of the site.

5.1.3 Environment Agency

The Environment Agency teams felt confident in their work at Walham; they are familiar with working in and around water and judged the risk from the flood water to be minimal; they had already deployed the barrier 6 times within the last year and were familiar with the task. The Environment Agency teams were briefed by the National Grid safety officers as to what restrictions were in place regarding the use of fork-lift trucks in the movement of barrier components, so they understood the parameters within which they had to work. However, the Environment Agency were not working completely independently of the other services; they needed the assistance of the RAF teams to move barrier components across the site, in order to complete the construction on time, and they shared the restricted site space and single access route with Fire and Rescue crews and their vehicles.

From discussions with the Environment Agency personnel, we can infer that the main elements of concern to them were:
• Completion of the Environment Agency barrier before high tide;
• Environment Agency lorry access to the site to deliver barrier components;
• Military support for barrier construction;
• National Grid restrictions on the use of lifting equipment.

Environment Agency personnel reported feeling frustrated by the slow pace of the Fire and Rescue Service and the lack of appreciation for the crucial role the Environment Agency played; Environment Agency vehicles were held up entering the site by the Fire and Rescue service and RAF teams sent into the substation to assist with the construction of the barrier were diverted to other tasks. The Environment Agency Operations Delivery Team Leader approached the Bronze Commander about the problem and subsequently access for their lorries was prioritised and military resources allocated to assist with barrier construction.

The Environment Agency teams normally work alone and it is rare that they would work alongside the Fire and Rescue service or as part of a multi-agency Major Incident response. The Environment Agency personnel spoken to asserted that it was their equipment, personnel and knowledge that had been crucial in the defence of Walham (“it was us that did it”) and that this was not recognised either by the Fire and Rescue service or in media reports of the incident. They were of the opinion that the Fire and Rescue service had treated the incident as a public relations opportunity and “an opportunity to dust off their gear”, as they brought in equipment “from all over the country” that was then in the Environment Agency’s way.

5.1.4 Military

The military reacted quickly to the request for assistance to the unfolding emergency at Walham substation, mobilising several groups of RAF personnel to the site at very short notice. However, the resources sent to Walham were given virtually no information on the nature of the emergency or the sort of equipment they would need to deal with it - they arrived without any Personal Protective Equipment (PPE – i.e. boots, gloves, waterproof clothing and life jackets) of their own, having simply been told to report to the incident and provide assistance. The Fire and Rescue Service did not have enough PPE for the military to use and had not realised that military resources coming to the site would not have their own equipment. The lack of PPE did not stop military involvement in the incident response, as the RAF teams got on with the job at hand (the Bronze Commander was told by one of the RAF COs “Don’t worry, they’ll do what they are told.”), but the lack of PPE remained a cause for concern for the Bronze Commander throughout the incident (see Section 7). Had the conditions been different, the military would not have been able to work on the site, with the possible outcome that the flood defences would not have been completed in time to save the substation. Whilst it may have been the case that the RAF teams would not have been able to procure the appropriate PPE at such short notice, even if they had known what equipment they needed, if the Fire and Rescue Service had known that the military were coming without
their own PPE, they may have been able to secure sufficient supplies to ensure that all personnel working on site were dressed appropriately for the conditions.

When the formal request for military assistance was made on Sunday 22nd July, 43 Brigade were able to move rapidly, already having several personnel at Gold Command and having developed a good understanding of the problems facing Gloucestershire emergency services. In addition, the SJC UK had already been briefed that a request for military assistance was imminent, enabling the process of achieving formal approval for military involvement to be completed swiftly.

5.2 Discussion

5.2.1 Contrasting perceptions of the same incident

The description above shows that there was inconsistency in the understanding of the incident – both across organisations and between levels of command. It would appear that within Gloucestershire Gold Command, there was a common appreciation of the importance of the incident and the broad strategic response, which was undoubtedly assisted by the shared physical proximity, access to common information and regular joint strategic meetings where discussion of the problem was encouraged. Gold Command also benefited from regular direct updates on the situation from Gold Liaison and reports from the military Liaison Officer.

Further down the command structure, this shared awareness begins to break down, as evidenced by the fact that Pseudo Silver was not aware of the significance of Walham substation. This was probably both due to the specialisation of ‘Pseudo Silver’ and the bypassing of Silver by ‘Gold Liaison’. This had the unintended consequence that Pseudo Silver was not in possession of all of the information necessary in order to prioritise the refuelling of emergency service appliances.

At the Bronze Command level there was still a common appreciation of the importance of the incident across the agencies, and several features of the incident that were seen as important were shared by the Fire and Rescue Service and the Environment Agency (for example: completing the barrier before high tide, site access and the role of the military). However, the Environment Agency and the Fire and Rescue Service still had very different perceptions of what was happening during the incident, their roles and the roles of the other agencies involved. From the Environment Agency perspective, the incident was straightforward, but the Fire and Rescue service were slow to adapt to the pace and type of incident they faced; during the early stages, the Environment Agency considered the Fire and Rescue Service to be ‘in the way’ - having more equipment on site than they needed and being slow to respond to access requests. From the Bronze Commander’s perspective, the incident was more complex, with many factors to consider and a number of equally critical aspects to the flood defences, of which the Environment Agency barrier was one part. The Bronze Commander was initially under the impression that the Environment Agency were able to get on with their role in the flood response independently, so he left them to it and concentrated his attention on other aspects of the incident. Once the Bronze Commander was made aware of the problems experienced by the Environment Agency, he gave orders to resolve them and subsequently maintained
closer contact with the Environment Agency Team Leader to ensure that this would not happen again.

We have shown that whilst there was some overlap in the aspects of the incident that the Environment Agency and Fire and Rescue service were interested in, the two organisations formed very different perceptions of the nature of the incident and the appropriate response. These contrasting perceptions of the incident and the multi-agency response held by the Environment Agency and the Fire and Rescue Service did not result in catastrophe; however, they serve to illustrate how different agencies working alongside one another on the same incident can have different understandings of the nature of the problem and the solution. In other words, shared situation awareness requires more than just the possession of relevant incident information, it also calls for a level of shared understanding.

Shared awareness is not merely possession of the same information, as we have shown; individuals are likely to select from the available information and attend to that which relates to their intended course of action. This is more about an appreciation of other agencies’ understanding of what this information means (their operational picture) and what needs to be done. This implies that relatively low shared awareness of incident information can be effective, as long as the relevant aspects are common across agencies.

The key issue is not the presentation of information, but the explanation of how or why the information is important (i.e. what it means), as this is based on experience and expertise that is not shared across agencies. It therefore requires a level of trust in accepting the other person’s viewpoint. For example, when the National Grid specialists told the Fire and Rescue Service that a certain depth of water within a critical area of the substation meant they would have to shut it down, the Fire and Rescue service did not need to know exactly why that was, or how the National Grid made this calculation in order to try to prevent the water reaching that level; however, they did need to trust the National Grid in order to be able to rely on that judgement.

The Environment Agency and Fire and Rescue services work together only infrequently and do not train together for multi-agency incidents. They are therefore unlikely to have a great deal of knowledge about each other’s working practices, such as the large size of lorries used to transport Environment Agency equipment, or the number of resources the Fire and Rescue Service might send to a Major Incident of this nature. If agencies are not familiar with each other’s working practices, do not share the same awareness of the situation and are not actively engaged in discussion about these matters (see Section 6 – Inter-agency Cooperation), then they are likely to come to misinterpret each other’s actions. The Environment Agency’s perceptions of the problems they experienced during the incident may have been affected by their impression that it was their role that was crucial; thus the Fire and Rescue Service’s slower pace is interpreted as getting ‘in the way’, not listening (“I’ll have to ask my boss”) and even having malign motives (a public relations exercise). It appears that a low level of awareness of how other agencies operate can translate into a lack of trust and that their ability and motives may be called into question when their actions deviate from what they are expected to do.

These two agencies have come away from this incident with impressions of each other that may have a negative impact on how they cooperate in future multi-agency
operations. Had the Environment Agency been aware of and accepted the wider picture of the incident as understood by the Bronze Commander, their perception of how the incident was being dealt with may have changed considerably. For example, if the Environment Agency personnel had accepted that the response was a joint effort (i.e. the need for sandbag barriers, High Volume Pumps and other Fire appliances to keep the water level down within the substation), this may have mollified their impression of being hampered by the Fire and Rescue Service. This is not meant as a criticism of the Bronze Commander, who was concentrating on coordinating the different aspects of the response; though this significant mismatch in situation awareness is partly due to the way that the different organisations cooperated during the response, which is discussed in the next section.

Given the frequent need to involve a wide range of experts and resources from a multiple agencies in order to resolve Major Incidents, this highlights a potential barrier to effective cooperation which responding organisations will have to overcome.

5.2.2 Ad hoc command restructuring

As the county-wide emergency response grew in size, the Fire and Rescue Service found themselves having to make changes to the command and control structure, such as creating ‘Pseudo Silver’ to concentrate on refuelling and ‘Gold Liaison’ to keep Gloucestershire Gold Command directly updated on the Walham incident. Additionally, the resources on the ground at Walham were primarily from Avon Fire and Rescue and the Avon command structure was still responsible for the resourcing of the incident (see Figure 5 in Section 4). It would appear that there were some side effects to this restructuring, including a lack of awareness of the nature and importance of Walham at the (Pseudo) Silver level of command. Avon Fire and Rescue Service command structure was also ‘out of the loop’ as they appear to have been dependent on the Bronze Commander for situation updates, which he did not have the time to provide. These problems illustrate that whilst the nature of the county-wide emergency required alterations to be made to the command structure, it is difficult to do this on an ad hoc basis and still ensure that the right information is still getting to the right people in a timely manner.

5.2.3 Liaison Officers

Military personnel working on the Walham emergency response were praised by both the Environment Agency and Fire and Rescue Service interviewees; they worked tirelessly in difficult conditions, without the equipment that was available to the other agencies, but the military also took steps to understand the problems they were faced with and moved swiftly to resolve them. Military involvement in the Gloucestershire floods featured the use of Liaison Officers at a number of levels, who worked hard to gain an understanding of the situation and communicate this within their own organisation. The JRLO role is identified in the ‘Strategic Defence Review – A New Chapter’ as being an important part of the military capability to support civil authorities:

“...Joint Regional Liaison Officers within each region to provide a single focal point representing all three Services. They will liaise between regional commanders and both
local civil authorities and Devolved Administrations, and will also co-ordinate Armed Forces’ participation in local and regional civil emergency control centres during crises…”

(MoD, 2002a, p24)

Elsewhere, Liaison Officers were also in evidence at the boundaries of organisations. The ad hoc restructuring of the incident command hierarchy effectively created new Liaison Officer roles; both Gold Liaison (liaising between Bronze and Gold) and Platinum Command (liaising between Gold and COBRA) worked to gather information and coordinate across command and organisational boundaries, suggesting that these roles were deemed necessary to enable effective development of shared understanding.

The military’s longstanding use of Liaison Officers during multi-agency operations suggests that the development of shared awareness or a common understanding across groups with different tasks, knowledge and experience is not something that happens easily and requires effort to achieve.

5.2.4 Role of technology in supporting Shared Awareness

The lack of an Incident Command Vehicle meant that the Bronze Commander was gathering information, collating and assessing it and then formulating the response plan almost entirely in his head; it was therefore impossible to readily represent the state of the incident and the response plan and for others to appraise themselves of the situation. This increased the workload of the Bronze Commander, in that fewer tasks could be delegated; it is also likely to have hampered the situation awareness of others within the Fire and Rescue Service command structure, limiting the ability for decision-making to take place lower down the command structure and possibly contributing to the command bottleneck that formed part of the Environment Agency’s frustrations. In addition, the lack of command support (which would have been provided by the Incident Command Vehicle) meant that there were problems with tracking the progress of all activities, so that some lower priority tasks ‘fell off the radar’ and were not dealt with; including making provision for refreshments for the personnel working on the site.

The ‘Strategic Defence Review – A New Chapter’ speaks of the need to ensure that military forces engaged in the support of the civil authorities have compatible communications equipment with the emergency services (MoD, 2002a); however, the Brigade Readiness Team were not issued with their own Airwave handsets, apparently for security reasons. The lack of secure digital radio access reduced communications between Walham site and military command to mobile phone communications, which have proven unreliable during other civil emergency situations. Not having access to emergency services radio communications may have also limited the Liaison Officer’s ability to develop an awareness of the state of the situation and the progress towards resolving the incident, as he was having to pass communications via the Fire and Rescue Service, rather than having direct access. The Military Liaison Officer was eventually able to obtain an Airwave handset and used this to communicate with Gold Command. He turned the handset off for a brief period the following morning, in order to have a brief rest; when he turned the handset back on, he was asked to authenticate his identity, as the handset had been reported missing. This demonstrates one of the difficulties in
trying to coordinate the involvement of multiple agencies at short notice and the understandable reluctance of the emergency services to hand out radios which can access their encrypted communications networks.
6 Inter-agency Cooperation

6.1 Overall response

The focus of this research was not on the higher levels of command; however, some impressions of strategic cooperation were gathered during the course of our interviews. According to 43 Brigade’s JRLO, the existence of the Gold Command facility was undoubtedly of benefit to the coordination of the wider incident response; for example, the shared workspace and provision of desks and facilities for partner organisations meant that the military were able to run their operation from the ‘centre of gravity’ for the incident, keeping the military and other agencies in close contact as well as keeping the military command and control structure together. In relation to Walham, this meant that when the situation changed (for example if the Bronze Commander had requested additional military support), the relevant people (i.e. the Police, Fire and Rescue and military commanders) were able to meet quickly to decide how to facilitate this request.

The Strategic Coordination Group meetings provided a forum for decision-makers from all of the relevant agencies to discuss the situation at a strategic level, which is likely to have enabled the development of a shared language and understanding of the nature of the incident across the agencies.

Figure 8 - Military personnel working within Gloucestershire Constabulary Gold Command (43 (Wessex) Brigade JRLO)
6.2 On site at Walham

6.2.1 Multi agency vs. sequential single service incident

Major Incidents involving resources from all three ‘blue light’ emergency services tend - in practice - to turn into what one interviewee described as ‘sequential single agency incidents’, i.e. where each service takes a lead role at different points during the response and they work on discrete tasks. An example of this could be a car crash, where several casualties have become trapped in their vehicles: the Police would close the road and move bystanders out of the hazard area, whilst the Fire and Rescue Service would make the vehicles safe, the Ambulance crews would stabilise the casualties, then the Fire and Rescue Service would be able to cut them from the wreckage so that the Ambulance Service could transport them to hospital (the Police may then investigate the scene of the accident and the road would eventually be cleared). However, the flooding incident at Walham substation featured multiple agencies working on the same tasks simultaneously and towards a common goal (i.e. to save the substation from flooding); as such it was a truly multi-agency incident. These tend to be rare – the Bronze Commander had only seen perhaps 2 or 3 in over 25 years of service. This overlapping of goals and tasks meant that close cooperation across the responding organisations was necessary in order to effectively deal with the incident and to prevent them from working at odds with each other.

6.2.2 Cooperation during the response

The main tasks requiring close cooperation were as follows (the main agencies involved are listed in brackets):

- Collection and assessment of site safety and response progress data, including water depths and dam construction development (RNLI, National Grid, Environment Agency, Fire and Rescue Service);
- Vehicle access to the site (Environment Agency, military, Fire and Rescue Service);
- Construction of Environment Agency barrier (Environment Agency and military).

The multi-agency response was a success; the combined defences kept the water level within the substation low enough to allow it to remain in operation through high tide and beyond, buying time for a semi-permanent flood defence to be constructed around the site. As was previously mentioned, the Bronze Commander felt that there was an extremely good work ethic from everyone involved in the response and that there were no particular difficulties when working with the other agencies; both the Fire and Rescue Service and Environment Agency praised the efforts of the military during the incident. However, the Environment Agency reported a number of problems that they faced in deploying their equipment, which they felt were as a result of having to work with the Fire and Rescue Service, including:
• The lorries delivering the Environment Agency barrier components were stopped from entering the cordon set up around the site; the lorry drivers did not have Environment Agency walkie-talkies, so were unable to tell the Operations Delivery teams that they had arrived. Nobody informed the Environment Agency teams that their equipment had arrived and it was not until the Operations Delivery Team Leader went looking for the lorries that they found out they had been stopped from entering the cordon;

• As the approach road to the site was reduced to a single lane by the double parking of emergency service vehicles, site traffic was being controlled by the Fire and Rescue Service, to keep vehicles moving. Environment Agency lorries were being held up in the queue of vehicles waiting to get onto the site, delaying the construction of the barrier;

• The Environment Agency teams walked along the flooded access road into the site, as the water was not deep or dangerous (and was only knee deep); they were surprised to see that the RAF units were held up from coming on to the site, whilst they waited for trucks to be brought up to carry them across the flooded road. Once they were on site, the RAF teams were then working in deeper water than they had crossed to enter the site;

• In order to construct the barrier on time and due to the restrictions on using fork-lift trucks on site, the Environment Agency needed assistance from the RAF teams to move their equipment into place. However, resources that were sent onto the site to help the Environment Agency never arrived at the Operations Delivery teams, as they had been diverted to assist with other tasks elsewhere in the substation.

The Bronze Commander reported that vehicle site access was a major logistical issue, as the Fire and Rescue Service, Environment Agency and others had a number of large vehicles to bring onto the site along the single lane access road. The Fire and Rescue Service manned the cordon around the site and introduced a one-way system to keep the site traffic flowing. Even then, some trucks were too large to be able to make one of the turns, so they then had to come back down the one-way lane. The Bronze Commander thought that some of the Environment Agency vehicles were the ones that had to come back down the one-way system, which may in part explain why they might have initially been held up from entering the site cordon.

The problems reported by the Environment Agency mainly relate to the control of access to the site, which breaks down into: a) permission to enter the site, and b) the prioritisation of access. The following sections of this chapter attempt to explore multi-agency cooperation on site during the incident to better understand why this happened.

6.2.3 Inter-agency Communication

The 2004 Civil Contingencies Act states that local responders have a duty to share information relating to capabilities, resources, processes and procedures, key personnel etc.
“Information is shared between Category 1 and 2 responders as they work together to perform their duties under the Act. Information sharing is a crucial element of civil protection work, underpinning all forms of co-operation”


The different agencies communicated on and off site through their own equipment. This incompatibility of communications meant that effective cooperation required physical proximity; the Bronze Commander kept Liaison Officers from the military and RNLI close by, as he needed to maintain constant contact with these organisations. He was also in constant contact with the HVP specialists, in order to monitor their progress in draining the site. The Bronze Commander was initially not in regular contact with the Environment Agency Team Leader, as he was under the impression that the Environment Agency personnel were able to undertake their work independently. The Environment Agency Team Leader was nearby, but the Bronze Commander concentrated on other elements of the incident response that demanded his attention.

The Fire and Rescue Service would normally prefer to confer more with the other agencies involved in an incident response and agree a coordinated plan of activity prior to starting work; whilst there was consultation and the establishment of consensus at Walham, the Bronze Commander reported that the scale and time critical nature of the incident prevented extensive dialogue between the agencies.

According to the Bronze Commander, communications did not present a significant issue during the incident. However, there appear to have been some problems regarding the communication of information within the Fire and Rescue Service, as the fact that Environment Agency lorries were at the incident cordon was not passed up the chain of command, or if it was, it did not reach the Bronze Commander or get passed to the Environment Agency. This may have been because individuals at lower levels of the Fire and Rescue command structure were not aware of the significance of the Environment Agency vehicles within the incident response, or equally, the Fire and Rescue personnel may not have known that the Environment Agency did not already know their vehicles had arrived. However, once the Bronze Commander was aware of the problems experienced by the Environment Agency, steps were taken to allow access to the Environment Agency lorries and to prevent further problems from developing, by having the Team Leader stay in close contact with the Bronze Commander.

The problems with the communication of relevant information were not all one way; the Environment Agency’s assessment of the floodwater on the approach to the site as being safe to wade through appears not to have reached the other agencies; the Military Liaison Officer reported that this stretch of water was thought to be dangerous and the RAF personnel were held up on entering the site whilst trucks were found to transport them through the water.

### 6.2.4 Shared awareness and inter-agency cooperation

Whilst the Environment Agency vehicles were being delayed as a result of the high levels of site traffic, so were many other vehicles; the reaction to this set of circumstances at least partially depends on subjective perceptions of the incident and each organisation’s role in it. Accounts of the discussion between the Bronze Commander and Environment
Agency Team Leader over the prioritisation of Environment Agency site access provide an illustration of how these different viewpoints may have led to different perceptions of the inter-agency cooperation during the response:

From the Environment Agency’s perspective, the Operations Delivery Team Leader approached the Bronze Commander to inform him of the urgent need to get the barrier components onto the site and assembled before high tide; he felt he had to impress upon the Bronze Commander that the overriding priority was to complete the construction of the Environment Agency barrier - which was critical - otherwise the substation would not be saved. Once the Environment Agency Manager, military Liaison Officer and Bronze Commander had conferred and reached agreement about the importance of the Environment Agency barrier, the lorries were given priority access onto the site and the Environment Agency and military began to unload and construct the barrier.

From the Bronze Commander’s perspective, several aspects of the response were equally important and it was part of his job to manage the coordination of the combined efforts; this included resolving Environment Agency logistics and access issues. The Environment Agency wanted to bring in barrier components on very large articulated lorries that were parked far back in the line of vehicles; if the completion of the barrier had missed high tide by 30 minutes, they would have lost the substation, so the lorries had to be allowed in. The sandbagging and pumping within the site was reasonably secure and not time critical, so the Environment Agency lorries were given top priority and all work was stopped to allow them into the site, which included clearing other traffic off the access roads to allow the larger vehicles to come back down the one-way system.

6.2.5 Military involvement

When each military team arrived on site they were briefed by the Bronze Commander or the Military Liaison Officer on the nature of the incident, the importance of the site and their role in the response; they were then allocated to work on the construction of the Environment Agency barrier. Once on site, the military teams worked under the direction of the Environment Agency personnel. The Military Liaison Officer remained with the Bronze Commander and translated his requirements into specific requests for the RAF teams.

The Military Liaison Officer at Walham saw himself as being part of the Bronze Commander’s staff; as such, he said he worked hard to develop an understanding of the incident and the commander’s requirements from the military, in order to communicate this to the COs from the different RAF teams. The Brigade Readiness Team Member spoke about the Liaison Officer role involving supporting and facilitating military involvement in support of the Bronze Commander’s aims.

Prior to this incident, the JRLO, Brigade Readiness Team Member and other military personnel had visited the emergency services around the South West region; military personnel are also involved in integrated emergency management meetings with Gloucestershire County Council and other emergency and response services. The military therefore knew what to expect on arrival at Gold Command and were familiar with how the emergency services coordinate the response during a civil emergency; the JRLO reported that the emergency services now know to phrase their requests for military
assistance in terms of the effect they want to achieve, and to leave the ‘how’ of the response up to the military to decide.

6.3 Discussion

Coordination of site access between the responding agencies appears to have been problematical, with apparent failures to request information from and present information to other agencies. This failure to ‘push’ and ‘pull’ information likely stems in part from a lack of awareness between the responding organisations (namely the Environment Agency and Fire and Rescue Service) regarding each other’s roles, methods and processes; it would be difficult to know whether another agency was following a particular course of action because that is just how they do things, or because they do not have the same understanding of the incident. This is likely to be exacerbated during a Major Incident, where the organisations are faced with a unique problem and it may not be immediately apparent what factors should be concentrated on. In addition, the potential for unfamiliarity between agencies to lead to misinterpretations of actions (discussed in Section 5) is unlikely to motivate individuals from different organisations to cooperate. Thus, there are mental barriers to cooperation between responding agencies.

The Environment Agency’s difficulty in accessing the Bronze Commander was also relevant, as he was something of a decision-making bottleneck in this incident, due to the lack of an Incident Command Vehicle (which is discussed further in Section 7). However, the different opinions of the success of inter-agency cooperation during the incident also suggest that this relates to the different organisations’ perceptions of their role and importance in the incident.

This incident demonstrates that close cooperation is crucial during multi-agency operations; the agencies involved had the same overall goal, but problems developed where they were competing for use of scarce ‘commodities’ (i.e. access and resources), which is a logistical planning issue, but which was exacerbated by gaps in their shared understanding of the situation.

6.3.1 Deconfliction

The difficulties in coordinating activity between the Environment Agency and the Fire and Rescue Service were more about conflict over limited use of the space available and allowing the most time sensitive resources (Environment Agency lorries) to have priority access. During close coordination of activity it is necessary to ‘deconflict’ the plans made by the various groups involved; this is something that we have observed during shared use of military airspace during very precisely timed operations. Deconfliction requires an early and detailed understanding of what everyone wants to do, i.e. “I want to bring in X articulated lorries...”, “I want to bring in Y trucks...”. At Walham, this was difficult to achieve, not least because the arrival times for equipment were hard to predict – large areas of the county were flooded and many roads were impassable. Additionally, communications with the vehicles to obtain estimates on time of arrival was not possible in a number of cases.
The lack of a compatible communications network across the responding agencies meant that cooperation on issues such as site access required physical proximity between decision-makers and the impoverished nature of command support tools would have made the task of logistical planning even more difficult.

The Fire and Rescue Service commented that they would normally spend more time discussing the plan with other agencies; these discussions may well tease out the requirements of the different agencies; however, Walham shows that, for various reasons, long discussions are not always possible. The result of this was that the high level goal of ‘save the substation’ quickly translated into conflicting plans on the ground.

6.3.2 Liaison Officers

It would appear that Liaison Officers work as an interface between different organisations, bridging their different languages, practices and perspectives on an incident. Indeed, the Military Liaison Officer from Walham commented that his role was to understand and communicate the needs of each agency on site. The value of this role was demonstrated by their effective use by the military and the number of ad hoc liaison roles that were created in order to address the particular needs of this incident and to ensure continuity of purpose across organisations and levels of command.

Organisations are likely to view problems in terms of their own domain of expertise; this is to be expected, as this is what they are trained to do. However this could present a barrier to cooperation during major incidents, where the nature of the situation is likely to require expertise from a variety of domains in order to achieve a successful outcome. There may also be a tendency for agencies to view an incident as ‘theirs’, with the other agencies playing a supporting (or hindering) role, which again may compromise the response to large incidents that require the skills and resources from multiple agencies.

Use of the Liaison Officer role demonstrates an understanding that it is necessary to gather information on the incident from all of the agencies involved and that establishing an effective working relationship with them is crucial to the swift resolution of the problem.
7 Command Intent

7.1 Strategic Coordination Group

As has already been mentioned, Gloucestershire Constabulary were in charge of the wider flooding emergency, but strategic decisions were taken in consultation with representatives of the other emergency services, the military and other agencies involved in the emergency response; this took place during the Strategic Coordination Group (SCG) meetings. These meetings were chaired by the Gloucestershire Constabulary Assistant Chief Constable who was designated Gold Commander. The purpose of the SCG is to provide updates on any new developments, to ensure that a common strategic approach is adopted across all responding agencies and to ensure all of the relevant issues are being considered; so whilst the Gold Commander has the final say, the expertise of the different groups in attendance will be drawn on during the decision-making process.

Whilst the Gold Commander would normally be the top level of the command hierarchy for a Major Incident, the Gloucestershire floods had the potential to have had national impact, due to the threat of the loss of electricity to other regions of the UK and the possibility of having to evacuate the county. Therefore, the Chief Constable under the role of ‘Platinum Commander’ also attended many of the SCG meetings. The Chief Constable provided the SCG with briefings from COBRA, gave direction on the wider strategic picture and defined the exit/handover criteria for the military. For example, the designation of Walham substation as being of “critical national infrastructure” would have focused the SCG’s attention on this site, as it had an impact beyond Gloucestershire alone.

7.1.1 Military Involvement

As was mentioned in Section 3, the formal request for military assistance came at midday on Sunday 22nd July. Military capability was requested to assist with:

- Distribution of life saving water;
- Engineering capability;
- Helicopter support for reconnaissance;
- Evacuation of vulnerable people.

The request from the SCG to the military came in terms of effects; it was then up to the military to decide on how to do this and what resources they would need. Military involvement through MACA was for the purposes of saving lives and alleviating distress amongst the local population, thereby filling a capability gap in the civilian service’s response caused by the exceptional scale of the flooding.
However, it was thought to be important to demonstrate as early as possible that the local authorities were in control of the situation and that normality was quickly being restored. To this end, within 24 hours of becoming involved in the flood response, 43 Brigade were formulating an extraction plan, to ensure that their involvement was to last no longer than absolutely necessary. As soon as tasks were completed, military resources were pulled out of the area (though they remained on stand-by). Once the last military units had been withdrawn, a press conference was held at Gold Command to report that there were no longer any military in the area.

7.2 Walham

7.2.1 Goal

The goal of each agency working at Walham substation was the same – to prevent the floodwater from forcing it to shut down. When this common goal was translated into a response on the ground, each agency was working to a different plan of action: the Environment Agency’s plan was to construct their barrier; the military were working to support the Bronze Commander (who directed them to work with the Environment Agency), whilst the Fire and Rescue Service were implementing a multi-layered response, of which the Environment Agency barrier was one part. Section 6 described how this difference in objectives led to problems during the incident response; this can partly be explained by the different perceptions of the nature of the incident and the role of each agency in the response (as discussed in Section 5). In addition to this, how the different agencies understood the command structure at Walham may also have influenced inter-agency cooperation.

7.2.2 Fire and Rescue Service

The Fire and Rescue Service was the lead organisation during the construction of the defences at Walham substation; they coordinated the activity of the various agencies involved and were also responsible for site access and the safety of the personnel working within the inner cordon.

The briefing given to the Bronze Commander upon taking over command at the scene was that if Walham substation were to be shut down, then around 500,000 homes and several sensitive sites would be without power for an extended period; the Bronze Commander was told that “We have got to save this if we possibly can.”

7.2.3 Fire and Rescue Service response plan

National Grid personnel told the Fire and Rescue Service that the critical part of the substation was the switching room; it was here that rising floodwater under the suspended floor threatened to force the substation to be closed. The threat to the switching room came from the anticipated high tide on the river Severn meeting the floodwater and further raising the water level within the substation. The uneven ground, use of aggregate and the presence of numerous cable ducts meant that it was impossible to make a fully watertight seal, allowing water to seep under the flood defences. The response strategy
was therefore to have a series of flood defences (sandbag walls and the Environment Agency’s flood barrier), behind which the floodwater would be pumped out. Water was pumped from under the switching room floor and from within the sandbag defences surrounding the switching room and external switching gear, as well as from within the Environment Agency barrier. None of the defences would have been entirely effective alone, but the combined effect of rings of defences was able to protect the substation through high tide, enabling interim defensive measures to be put in place, whilst a more long term solution was found.

The designation of Walham as being of “strategic national importance” mean that the Fire and Rescue Service were not limited by the availability of resources, which would normally be the case during incident responses. This was why 8 High Volume Pumps and numerous other specialist units and appliances were sent from around the country to the site; being of national importance prompted a much larger response than would otherwise have been the case, as this response would have been a big drain on national Fire and Rescue capability.

7.2.4 Command handover

The Bronze Commander took command part way through the incident (the consolidation phase) - when there were already resources at the scene - and was given a briefing by the outgoing Incident Commander. The response was being put into place; however, the Bronze Commander identified some ‘holes’ in the plan that had not yet been addressed and set about resolving these. For example, there was no evacuation signal, should the need to rapidly clear personnel from the site arise.

The Bronze Commander described the incident as simple and a ‘no brainer’ in that the problem was evident (the substation was threatened by rising floodwater, which would peak at high tide during the night), it remained static over the course of the incident and there was a clear solution, which involved protecting key areas of the site and pumping the water out faster than it was able to get in.

7.2.5 On-scene Fire and Rescue command and control

The Fire and Rescue Service were in charge of the incident; where possible, they discussed the situation with the other agencies involved, but the Fire Service made key decisions and directed the other agencies involved in the response. For example, the Fire Service instigated and controlled the one-way access system to the site and the Bronze Commander made the decision to allow military personnel to deploy in the flooded areas of the site without Personal Protective Equipment (PPE). The Bronze Commander also evacuated all non-essential personnel from the site as high water approached, due to the increased risk of a breach of the defences.
7.3 Recognition of Command

7.3.1 Environment Agency

The Environment Agency recognised that the Fire and Rescue Service were in control of the site and that they were concerned with the safety of personnel working there, but some of the comments made to us suggested that they were not comfortable with the command situation and that they may not have recognised the ‘primacy’ of the Fire and Rescue Service.

The Environment Agency are normally the sole organisation at work on the incidents they are sent to, they are therefore used to being in control of every aspect of their work; as the Environment Agency role at Walham was to construct their barrier, on the face of it, it was just like a standard Environment Agency incident. Given the very different understandings of the issues involved and the nature of the incident response, it is therefore unsurprising that there may have been some initial reluctance to accept direction from another agency.

7.3.2 Military

The military resources at the scene recognised the authority of the Bronze Commander. The Military Liaison Officer saw himself as being part of the Bronze Commander’s staff; the Bronze Commander would tell him what he wanted from the military, the Liaison Officer would then in turn discuss this with the COs from the RAF teams to see if they thought it could be done. The COs were in command of their own teams and were in turn operating under the direction of the Brigadier, though their instructions were to support the Bronze Commander wherever possible.
7.4 Decision-making

7.4.1 Fire and Rescue decision-making process

Figure 9 - The Incident Command Model as used by Avon Fire and Rescue Service

Figure 9 is the Incident Command Model as defined by the Fire and Rescue Services and, as such, it describes the process that Fire Incident Commanders follow during the resolution of Major Incidents; the model identifies two main activities – deciding and acting. The stages to the left of the model (gathering and thinking about available information, identifying objectives, defining a plan and considering the results of evaluations) fall into the ‘deciding’ activity, whilst the stages to the right (communicating the objectives and plan to personnel, controlling the activity and evaluating the outcome) fall within the ‘acting’ activity.

The key decisions as defined by the Bronze Commander during the consolidation phase were (in no particular order):

1. To put the local quarry on stand-by (30 minutes notice to move) to deliver sand for sandbag flood defences;
2. Placing fire appliances in ‘at risk’ positions;
3. Deploying military personnel without Personal Protective Equipment (PPE);
4. Risk assessment of floodwater;
5. Clearing non-essential personnel and vehicles out of the site.
We will look in detail at the decision to deploy military personnel without PPE (i.e. boots, gloves, high visibility waterproof clothing and life jackets) as this relates to the wider issues of site safety, which affected all agencies working on site.

7.4.2 Managing site safety and deploying military personnel without PPE

The Fire and Rescue Service would normally manage site safety by monitoring everyone entering the ‘hazard zone’ and where/what they are working on. However, at Walham there were too many people moving on and off the site for them to be able to do this; instead, they were forced to look at overall site safety.

In order to determine whether it was safe for personnel to work on site, information on a number of factors was collected and combined to produce an overall risk assessment for the site. The National Grid established safe working practices for personnel operating in ‘live’ areas and defined a maximum depth for floodwater to reach before it would become too dangerous to remain on site. RNLI crews monitored water depths around the site and assessed floodwater risk to personnel, as well as reporting on compliance with PPE use by personnel on site. The Fire and Rescue Service took information from all sources, and the Bronze Commander assessed the overall risk to personnel working on the site. It was determined that the risk of an accident that would affect more than one person was low. It was explained to us that it was not possible to completely remove the risk of an accident involving an individual, as this was a busy construction site. An improvised evacuation signal was developed, as communications systems were not compatible and the whistles used by fire fighters would not be heard over the noise of the pumps. Instead, an emergency services vehicle that was parked in a prominent position was chosen and the evacuation signal was the use of the lights and siren on that vehicle.

Risk factors were regularly checked and the assessment of the level of risk to personnel working on the site was regularly reviewed. Near high tide, there was a concern that a breach in the flood defences could allow floodwater to suddenly overwhelm the substation, thereby causing an accident involving many people. This changed the level of risk to personnel working on the site and so the Bronze Commander took the decision to pull all but a few essential personnel out of the site.

As was mentioned in Section 5, the RAF teams who were sent to Walham arrived without any PPE of their own and the Fire and Rescue Service did not have spare equipment available. This would normally mean that individuals would not have been allowed to work within the hazard zone of a Major Incident, but given the importance of the site the RAF COs authorised their deployment; however, with overall responsibility for the safety of personnel working on site, the Bronze Commander still had to assess the risks associated in working on the site without PPE before the teams could be deployed. It was determined that the floodwater did not pose a significant additional risk to the military personnel; the water was neither deep nor fast flowing – if someone had been knocked over or carried off by the water, then it would only have been into one of the surrounding fields or a hedge. The RNLI crews patrolling the perimeter of the site were a further control measure, as they were able to check on the welfare of personnel working on site and report this back to the Bronze Commander; they would also have gone to the assistance of anyone in difficulty. It was therefore decided that, whilst the lack of PPE
was not ideal, the RAF teams could be deployed onto the site to assist in flood defence construction. As with wider site safety, use of the RAF teams was regularly reassessed to ensure that the level of risk to them had not become unacceptable.

Had certain features of the incident been different, then the decisions taken regarding the nature of the response would have had different outcomes. For example, if Walham been on the banks of a large river or near the sea, or if the water had been very cold, then personnel would not have been deployed without PPE.

This description of the risk assessment of the site and the decision to deploy personnel without PPE demonstrates the Fire and Rescue Incident Command Model shown in Figure 9 and shows how information and judgements from other agencies may be required to provide input throughout this decision-making and C2 model during multi-agency operations.

### 7.4.3 Environment Agency decision-making

The Environment Agency’s task at Walham was to construct an approximately 1 kilometre flood barrier ring around the site. As this task was familiar to them, they did not need to hold any site meetings to discuss how this would be done. The only issue they faced with the construction of the barrier was that they did not have enough personnel to complete the task before high tide and so were reliant on assistance from military personnel.

The Environment Agency teams were experienced in working in and around water and reported that all of them were empowered to carry out dynamic risk assessments throughout an operation, and that at no point were they concerned regarding the risk from the floodwater. In terms of the risk from the live substation, the Environment Agency took direction from the National Grid, who specified the restrictions on their use of lifting equipment. The Environment Agency teams were then happy from a health and safety perspective as they recognised that the National Grid personnel were experts on this and trusted their judgement.

### 7.5 Discussion

#### 7.5.1 Defining and communicating Command Intent

As was mentioned in Section 5, different agencies are likely to have different perspectives of an incident; this was also likely to be the case at Gold Command level – each agency was no doubt focusing their attention on their own area of interest/influence and may well have considered this the ‘top priority’. Whilst the SCG is used to raise and discuss issues arising during an emergency, it allows the Gold Commander to tell all of the other agencies involved what the priorities are – the commander can impose their strategic perspective over the other agencies’ priorities (i.e. defining the commander’s intent). This ensures that at a strategic level, organisations know what the priorities are and their role in bringing them about.
At the Bronze level, as was previously mentioned, the Bronze Commander reported that though consultation took place and the different agencies reached a consensus on the plan of activity, time pressures prevented extensive dialogue. On the face of it, all agencies shared the same overall goal and were clear on what needed to be done. However, some organisations appear to have been working to their own priorities, rather than the Bronze Commander’s; whilst these priorities were broadly the same, this may explain the mismatch in perspectives of the incident and why the Environment Agency may have felt that they were being obstructed by the Fire and Rescue Service, who were trying to balance the competing requirements of different aspects of the response. In addition, there may have been a more fundamental reason for the mismatch between some of these agencies, to do with the recognition and acceptance of command authority; both the Fire and Rescue Service and Environment Agency are Category 1 responders (under the Civil Contingencies Act, 2004) and are used to being ‘in charge’ of their own operations.

Whilst this incident was simple (in the words of the Bronze Commander) and the nature of the problem was relatively static, during more complicated incidents this issue could have led to more significant problems, resulting in an unsuccessful response to the emergency.

Once again, the role of military and ad hoc Liaison Officers was important, this time in promulgating intent across organisations and levels of command.

7.5.2 Continuity of command

There are likely to be a number of commanders over the course of long and complex incidents, with the first on-scene Commander being relieved when a more senior Officer arrives to take charge and then later on, when the Commander and crews are relieved by the on-coming shift. The Fire and Rescue Bronze Commander we interviewed took control part-way through the incident at Walham and was relieved after the critical high tide period had passed. The handover between commanders is therefore important, to ensure that all relevant information is passed to the new Commander so that the incident continues to be resolved as quickly as possible; it is likely to focus on the outgoing Commander’s situation awareness and intent relating to the incident (i.e. the nature of the problem, the current state of the incident, the plan to resolve it and the current progress in achieving that plan).

The transitory nature of the Incident Commanders presents potential dangers, such as if crucial details of the incident are not relayed or are misinterpreted. However, it also allows a fresh perspective on the incident, enabling the new Commander to identify any holes in the current plan and to take measures to resolve these. A further potential difficulty with changes in Commander during an incident relates to inter-agency cooperation; how can relationships between agencies who work together only infrequently be developed and maintained in an environment where personnel may change several times during a single incident? The outcomes of inter-agency discussions and local, ad hoc arrangements may not form part of formal command handover procedures, which may risk organisations ‘forgetting’ agreements and thereby compromise cooperation. Given the importance of trust across agencies and the need to
share intent across the organisations involved, this has the potential to negatively impact the effectiveness of the response to the incident.

7.5.3 Adaptation during Major Incidents

The improvised role of ‘Platinum Commander’ shows that there comes a point where the Bronze, Silver, Gold Major Incident hierarchy is insufficient to deal with the magnitude of an emergency. This and other ad hoc changes again demonstrate the requirement for command structures to be able to adapt to extraordinary situations. A further point of note regarding the Platinum Commander role is that the Police are operationally independent from Government; whilst they take strategic direction from the Home Office, Police forces are not directly accountable to the Home Secretary and would not normally have such a direct link from the Cabinet down to a specific incident. Whilst there were still a number of levels in this chain of command, there might be a danger that greater political visibility and ‘strategic direction’ for a particular incident could lead to political interference in tactical and operational aspects of the response.

On site at Walham, the large numbers of responding agencies and individuals, combined with the lack of command support from an Incident Command Vehicle appears to have overwhelmed the ‘control’ aspect of the command and control capability. The Fire and Rescue Service therefore adapted their working practices to the situation, as it became apparent where they were not suited. As with examples in earlier sections of this report, this illustrates how the constraints of the situation can force decision-makers to adapt virtually everything else, including the breaking of organisational rules and cultural taboos.
8 Human Factors and Organisational Aspects of Search and Rescue

8.1 Approach

This chapter will consider the activities involved in Search and Rescue (SaR) from a high-level perspective in order to outline the organisational structure and processes that affect current operations. The aim is to provide a generic description of SaR in order to show the challenges and opportunities for coordination of these activities.

Information was collected from two primary sources: literature in the public domain that related to Search and Rescue activity, and discussion with Subject Matter Experts, i.e., two experienced helicopter pilots, and one Royal National Lifeboat Institute (RNLI) coxswain. Given the nature of this information, it was not possible to develop detailed task analyses of operations, so the main focus was on identifying the key roles played by the different agents in Search and Rescue. The aim was to gain insights into how SaR is organised, particularly in terms of the variety of agencies that are involved in operations. For this exploration, a broad description of operations was used to infer high-level organisation charts, which were analysed in terms of social network analysis.
8.2 Search and Rescue process description

A review of literature in the public domain resulted in a description of the Search and Rescue process as comprising seven steps.

8.2.1 Step One: Receive emergency call

An incident at sea, in coastal waters or in the mountains could lead to an emergency call. Examples of the manner in which a call could be made range from ship-to-shore radio (or telephone to 999 call centre) from the persons involved or passing shipping, to distress signals (e.g., flares) to Marine Coastguard Agency (MCA), or from observation by a member of the National Coastwatch Institution. Alternatively, if an expected type 3 report on the Automated Mutual Assistance Vessel Rescue System has not been delivered to the port at which the vessel is supposed to arrive, then a call could be raised. In military incidents, a signal emitted by a Personal Locator Beacon (PLB) of a downed pilot received by the Airborne Warning And Control Systems (AWACS) in a Nimrod aircraft over the area; or from a report from an incident on an off-shore platform. These represent a subset of possible routes via which an emergency call is raised but are sufficient to highlight that there is likely to be a range of callers with different quantity and quality of information on which to base a rescue decision. The call handler will receive sufficient information to pass on to the closest Maritime Rescue Coordination Centre (MRCC) who will take responsibility for managing the response in the first instance. At this stage, the primary activity will centre on collecting as detailed information as possible and relating this to local knowledge in order to determine an appropriate response.

8.2.2 Step Two: Define response and request resources

The Watch Manager of the MRCC will make an initial assessment of the situation, on the basis of available information and local knowledge, and then request resources to assist in the response. The planning activity will involve receipt of messages and categorisation of message type, e.g., background, environmental, SaR requirements, existing case etc. For existing cases, any relevant information will need to be transferred to appropriate agencies. A Watch Officer will seek additional information and help the Watch Manager to define the objective area, resource requirements and procedures and produce an initial search plan.

For rescues from coastal waters, the response it likely to focus on the use of lifeboats from the RNLI or the Coastguard Rescue Teams, but for incidents out to sea or in mountainous regions then a helicopter will be requested. Depending on the location of the incident, the helicopters could be supplied by Her Majesty’s Coastguard, the Royal Navy, the Royal Air Force or private companies (e.g., related to off-shore oil and gas platforms).

RNLI Control will receive a request to launch from the MRCC and will then contact the local Lifeboat Operations (LBO) Manager who will assess the situation and determine the possible options. If a decision to launch is made, then the LBO will contact the Senior Watch Officer at the lifeboat station who will activate the crew’s pagers.
Military helicopters, i.e., Royal Navy or Royal Air Force, will be coordinated by the Air Rescue Coordination Centre (ARCC), who will receive the initial request from the MRCC. The ARCC will scramble the most appropriate helicopter and inform the MRCC of an estimated time of arrival on scene. The ARCC will manage military airborne resources, e.g., liaising with relevant Air Traffic Control (ATC) centres and advising on the location of the incident, but the MRCC will coordinate any local responses and collect additional information. For example, the MRCC might provide access to local Medical Support in order to gather additional information on the state of a casualty and provide immediate first aid advice.

8.2.3 Step Three: Tasking and assignment of On-scene Commander

Having defined a rescue, there is a need to plan the mission and the tasks to be performed by the different agents. Air assets (including Police and Air Ambulance) are likely to use the EasyTask tasking system. However, this does not mean that other, e.g., maritime assets, will have access to the same information. Once on the scene, the helicopter pilot will be able to assess the situation and can assume the role of on-scene commander if appropriate. If a long-range search operation is being conducted, then ARCC will launch a Nimrod (coordinated by E3D) who will take the role of on-scene command. If a lifeboat is launched then the coxswain might assume on-scene command, or this role might be retained by the MRCC. The point is that there can be several agents who could take on the role of on-scene command. It is not impossible for more than one agent to assume that they are on-scene commander. This indicates a need to retain good communications between all parties (which current radio technology does not always support). The on-scene commander will coordinate local activity, maintain reporting to MRCC and ARCC and request resources if required.

8.2.4 Step Four: Conduct search

For maritime search operations, there are several forms of search pattern that could be flown depending on such factors as area to search, weather conditions, object of search etc. For mountain rescue operations, there are additional search patterns, both airborne and ground-based. It is plausible that search for both mountain and maritime rescue will involve more than one set of agents. For example, maritime search might involve the MRCC requesting ‘vessels in the vicinity’ to keep watch and report anything of interest, or might involve more than one helicopter, or might involve helicopters and Nimrod; mountain rescue might involve mountain rescue teams on foot and helicopters. Obviously the combination of resources will depend on the situation, but the point to note is the need to gather together information from several sets of agents working relatively independently. The results of the search, e.g., location of the object, will need to be reported and updated. The ARCC will relay information between the military aircraft and the MRCC or Mountain Rescue Team (MRT) as required.

8.2.5 Step Five: Plan and rehearse rescue

The on-scene commander will need to plan the rescue and discuss this with the crew and local resources. The rescue, if there is time, will be simulated or rehearsed.
8.2.6 Step Six: Conduct rescue

The rescue will involve rescue of any casualties and their immediate treatment if required, and recovery to a place of safety or treatment. The rescue could be effected via winch or with the aircraft on the ground, and recovery to the hospital could involve transfer to an ambulance or direct flight to the hospital. The ARCC will contact either the Ambulance Dispatch Centre or the hospital.

8.2.7 Step Seven: Return to base

Following successful completion of a mission (or an agreement to terminate the mission), the helicopters return to their bases for after mission review and maintenance checks.

8.3 Implications for ‘network structure’

In previous research by the HFDTC a distinction is drawn between ‘networks of exploration’ and ‘communities of practice’ as different network structures (Houghton et al., 2008).

A ‘network of exploration’ will, typically, have a central node and several peripheral nodes, e.g., in a ‘star’ formation. The network arises when information from several sources is being supplied to a central coordinating node. The primary purpose of such a network is to have a focal point for the assimilation of information and the assessment of the situation. The central node will then pass the situation assessment to key parties who need to know this. Thus, for step one, the central node will be the MCA in the first instance (following hand-over from the 999 call centre), and will then move on to the appropriate MRCC. At this step, the central node will be looking to connect to relevant other nodes in order to gain a good overview of the situation. Thus, the MRCC might request future reports on weather conditions from the meteorological office or might draw on local knowledge to gauge potential developments.

![Figure 11 - Examples of a ‘network of exploration’ derived from observations of Fire Service operations](image)

A ‘community of practice’ will, typically, have a central node from which two or three lines of nodes spread. The network is designed to optimise information flow to agents who are performing standard operating procedures in a reasonably well-defined domain. This latter point does not mean that all information is to hand but that the agents know what procedures to follow and what information is required. For example, an experienced helicopter crew following a defined search pattern would constitute a ‘community of
practice’. If there are two or more helicopters following search patterns, then these could constitute independent ‘communities of practice’, with, perhaps, a weak link between them via a central node (such as the ARCC).

Figure 12 - Examples of ‘community of practice’ derived from observations of Police emergency response

It is proposed that the ‘community of practice’ represents an optimal response to a well-defined situation, in that it allows agents to adhere to standard operating procedures. One would anticipate that the majority of SaR missions would follow such a model. One implication for this is that a set of agents can work fairly autonomously, focusing on their own area of activity and concentrating on their own procedures. Multi-agency operations often take the form of a linear sequence of ‘communities of practice’ with each agent performing its procedures and then allowing the next agency to step in and do their work.

Any overlap between sets of agents would either be coordinated through local communications between agents on-scene (if this is possible) or via a central node (such as the on-scene commander, ARCC, or MRCC). However, there may be situations in which either the communication is not available or the coordination is more complex than can be supported by simple information exchange. In such instances, we would argue, the network will turn into a ‘network of exploration’ and require collection of information from several sources in order to establish an appropriate situation awareness. This raises a potential problem with the sort of multi-agency response that might occur in complex missions.

The social networks are evaluated using several metrics. In this report, the metrics of density, diameter and degree are used. The density of a social network describes the amount of connections in the network relative to the number of possible connections. This means that the higher the density, the greater the amount of connectedness between agents in the network. The diameter describes the maximum geodesic distance in the network. The geodesic distance is the shortest path between two points, and so the diameter indicates the extent to which very distant nodes can impair communications in the network. Degree describes the number of connections to and from a node and can show how well connected different agents are in the network.
8.4 Mountain Rescue operations

Figure 13 shows a social network diagram based on the Chapter 6 “Search and Rescue Operations” of the *Mountain Rescue Training Handbook for Royal Air Force Mountain Rescue Teams*.

The network involves 19 ‘agents’ (although in some instances, e.g., MRT, this might include more than one person). The thicknesses of the lines imply the strength of connection between the agents. The network has a diameter of 5 and a density of 0.091. This indicates that a message in the network could require up to 5 steps to reach its intended recipient, and that the network utilises only a small number of possible connections. Visual inspection of figure 13 suggests three main cliques (surrounding the Station Commander, the ARCC, and the Casualty) with minimal connectivity between these.

Analysis of the degree of the agents suggests that the ‘key’ agents are on-scene commander (one assumes this would most likely be the leader of the MRT, but could be the helicopter pilot under some circumstances), ARCC, MRT, and Station Commander.

Considering the links between nodes, the ARCC will be highly connected in this network because of its role in liaising between different agencies. Furthermore, current operations mean that many of the links may well be performed through face-to-face communications rather than via radio. For example, the MRT might speak with the pilot when the
helicopter has landed in order to plan a search, and updates of the search will be passed by ARCC between pilot and MRT (assuming the MRT have radio communications – it might be the case that the MRT sets up a mobile command post some distance from the search activity and needs to have someone carrying information between the two sites).

8.5 Maritime Rescue involving Lifeboats

The second comparison scenario involves the cooperation of Her Majesty’s Coastguard, Royal National Lifeboat Institution and military helicopters in a maritime rescue. The example is based on an incident report presented below:

At 0045 on 6 June 2006, a deckhand on board the UK-registered scallop dredger Danielle became trapped by a rope that was being used on a winch whipping drum. He sustained serious arm and chest injuries and was evacuated by RNLI lifeboat and ambulance to hospital, where subsequently his arm had to be amputated. The deckhand had been “tipping” each scallop dredge individually, using several turns of rope around the whipping drum on the port side of the winch house, when a riding turn developed. In an attempt to stop the winch and clear the riding turn, the deckhand slipped on the recovered dredging gear lying on the deck. His left hand became caught in the rope between the winch head and the framework beneath, and he subsequently did two backwards somersaults around the whipping drum and framework. On both occasions he was unable to reach the stop due to this framework, and it was only once his left arm had broken and shoulder dislocated, that he was able to stop the winch and avoid being dragged round it a third time. The deckhand was freed from the whipping drum and helped into the galley. He had lost several fingers, and fractured and severed his upper left arm. His t-shirt had been forced into the wound, and was helping to stem the blood flow, and he also had red chest rashes, an indicator of his nine fractured left ribs and punctured left lung. The skipper contacted the Maritime Rescue Co-ordination Centre (MRCC) at 0054 to report the accident, stating that they were 16.2 miles SSE of Falmouth, and steaming in at top speed. A link call between the skipper and a radio medical advice doctor in Portsmouth was facilitated by the MRCC. During this conversation, the skipper provided a detailed description of the injuries, including the chest rashes, but on several occasions the doctor tried to interrupt for clarification, and might not have heard all the details. The MRCC and the doctor subsequently agreed that the deckhand required evacuation to hospital and that this would most appropriately be carried out by the Falmouth lifeboat, with their volunteer Lifeboat Medical Advisor on board. The possibility of using a helicopter from the nearby Royal Naval Air Station Culdrose was discounted, due to the 45 minute airborne night response time. At 0107, Danielle’s skipper provided an update to the MRCC, reporting that the deckhand was experiencing breathing difficulties, and had a semi-severed arm, with a possible neck/spinal injury. These details were passed onto the doctor at 0113, but it was agreed that the lifeboat was still the best option for providing assistance. The deckhand was subsequently evacuated by the lifeboat, with a land ambulance completing the transfer to Truro hospital, where he arrived at 0334, 2 hours and 40 minutes after the initial VHF call.

1 http://www.emsa.eu.int/Docs/accidents/24-124.pdf
This network has 33 agents, a diameter of 8 and a density of 0.046. This indicates that messages in the network could involve up to 8 steps to reach their intended recipient, and that the network utilises a smaller number of possible connections than that described in 8.4. Visual inspection of the figure 14 suggests that there are several single connections between agents, but no obvious definition of definable cliques (albeit the agents linked to the MRCC). From an analysis of degree, the key agents are Watch Officer (of HMC), MRCC, MRCC radio operator, Central Operations Incident Room (COIR), Lifeboat and Skipper (of yacht). Thus, the incident is being managed by MRCC, which assumes on-scene command. While ARCC and helicopters are part of this response, their role is less central.

8.6 Consolidated models

In addition to focusing on two specific types of operations, composite models were produced on both of the scenarios in chapter 8. While this gives an unrealistic structure, in terms of operational activity, it does provide an overview of the nature of connections between agencies and the potential emphasis on the relationships between different agents.

Figure 15 shows the consolidated model produced from the literature review. There are 71 agents in this network. Analysis of degree suggests that the most important agents are:
ARCC, MCA Watch Officer, MRCC, and on-scene commander (who might come from one of several organisations depending on the nature of the incident and response).

8.7 Use Case analysis

In addition to analysing the potential relationships between agents, the association between agents and the functions they perform was mapped. In this case, a form of use case diagram is used to show which agents are linked by different functions. For this analysis, a consolidation of all networks was used purely for illustration purposes. The following figure illustrates the potential utility of this approach. One can see that the diagram forms cliques of agents and functions, and this implies the forming of small teams to deal with specific objectives. In some instances, for example, in the bottom right-hand corner, these teams centre upon a specific node (in this case, MRCC) and arise from the need to coordinate functions. In other instances, these ‘teams’ seem to relate to...
less tangible groupings. For example, in the bottom centre of the diagram, there is a grouping around ‘scramble helicopters’, which at first glance, seems to be a disparate set of agents. However, reflection on this grouping might lead one to conclude that there is a need for a variety of agents to have knowledge about the launching of helicopters and their estimated arrival at a scene.

Figure 16 - Clusters of Agents and Tasks

8.8 Implications for Command Intent

At the commencement of the rescue, the Watch Manager in the MRCC will develop a search plan, outlining the area and nature of the search and defining initial resource requirements and objectives. This can be thought of as the initial intent of the ‘system’. As with any complex activity, the plan will require updating and modifying in the light of incoming situational information. As sets of agents are mobilised and move to the scene, then it is likely that each set will generate its own objectives, either in response to the situational demands or in response to the overall intent set out by MRCC. This introduces an additional level of complexity into the system in that the intent of each set of agents might not be communicated with other sets of agents. This could be characteristic of the community of practice approach with separate sets of agents. Having some means of sharing and updating the intent of each set of agents becomes important to avoid interference of activity and support collaboration. This could be performed by local communications, providing there is appropriate radio communications between agents, or could be performed through some central, coordinating node. In terms of this latter point, if one assumes a fairly common scenario of the MRCC coordinating the rescue, the ARCC coordinating the military assets being used and the COIR coordinating lifeboat
response, then one can imagine a heavy communications load associated with simply maintaining a shared sense of the objectives being pursued by each set of agents.

8.9 Implications for Situation Awareness

The sharing of where assets are and what actions they are performing is essential to efficient coordination, and this is central to the concept of shared situational awareness. The helicopter pilot will, for example, provide updates on activity to ARCC when possible to update on location and activity. The ARCC will then distribute this information. In terms of the activity of other assets in the system, the on-scene commander will need to be able to gather situation reports from key assets in order to coordinate activity. In the case of mountain rescue, communications problems can be particularly problematic in terms of maintaining a continued connection. A further issue relates to the demands on the individual’s attention from the situation and their ability to divide their attention between verbal updates and managing the situation. This might mean a delay in updating during periods of intense activity, which, paradoxically, could be the time when updates would be of most use to the coordinator.
9 Coastal Town Flood Scenario

9.1 Introduction

The flood scenario described in this section of the report is based on the Boscastle Flood of 16th August 2004. Publicly available reports and press releases were used to generate a descriptive narrative and timeline of events; these are listed in the Reference section of this report and included material from:

- Aeronautical Rescue Coordination Centre
- BBC News
- Environment Agency
- North Cornwall District Council
- South West Regional Resilience Forum
- Maritime and Coastguard Agency

During the creation of the descriptive narrative and timeline some minor alterations have been made and timings were approximated where unavailable.

9.2 Summary

On Monday 16th August 2004, heavy rainfall in north Cornwall caused a flash flood in a coastal village. The village is a popular tourist destination and about 1,000 residents and holidaymakers were thought to have been at risk. The first rainfall was recorded on land above the village at about 12.30pm, with heavy rainfall falling in a concentrated area over the next few hours. The river that runs through the centre of the village quickly became a torrent and overflowed; an estimated three-metre depth of water poured through the village, washing away cars and trapping residents and tourists (Figure 17). The emergency services implemented a Search and Rescue operation, involving HM Coastguard, Police, Ambulance and Fire and Rescue Services, the District and County Councils and the Environment Agency. The Highways Agency, the Cornwall Rescue Group and the Women’s Royal Voluntary Service (WRVS) also provided assistance. This rapid response helped ensure that there were no fatalities.

Figure 17 – Boscastle town centre during the flood. The ground floor levels of several buildings are almost completely submerged, indicating the depth of the water (Environment Agency). – Picture removed due to copyright
9.3 Incident precursors

The Meteorological Office had forecast heavy, often torrential downpours developing over the region through the day, but were unable to say exactly where these would develop. Heavy rainfall began in the area around the village at 12pm; a local rain gauge later recorded 12mm (half an inch) in 15 minutes. About 75 mm of rainfall (the average for the whole month) fell in two hours. The sudden rainfall caused two rivers to burst their banks and a wall of water flowed through the main street, washing cars, walls, and river banks away.

9.4 Initial response

The Environment Agency opened their regional flood incident room in response to the reported heavy rainfall. Calls came in to the emergency services that several roads had flooded and that the rising water had trapped people in their cars in the town car park; Fire appliances were dispatched; however, flooded and blocked roads hampered emergency access to the town. HM Coastguard were alerted at 3.45pm that the river level had risen 6-7 feet within an hour; the town Coastguard Rescue Team were immediately called out, along with teams from neighbouring villages. The Coastguard Rescue Teams organised the rescue and evacuation of villagers. Fire Service teams arrived and assisted in moving people to dry land. HM Coastguard also dispatched two Search and Rescue helicopters and two in-shore lifeboats to the incident.

The level of the floodwater rapidly rose and over 100 properties were flooded; people trapped in their houses moved to the roof or upper floors; cars in the car park began to be carried away by the floodwater. Trapped people were in danger of developing hypothermia and from being swept away by the rising water. Debris carried by the floodwater damaged buildings in the town, including one in which people had become trapped.

9.5 Major Incident

As the situation deteriorated, the rising water level forced the emergency services at the scene to pull back to a safe distance. Several buildings began to collapse and it was not known if anyone had been swept away, or whether people were in any of the cars being washed into the harbour. The helicopters arrived and begin to evacuate people from the roofs of houses; one crew reported back to HM Coastguard that the worsening situation was putting the whole town at risk, prompting HM Coastguard to declare a Major Incident at 4.35pm. The emergency response plan was put into action, coordinated from Gold Command at the regional Police Force headquarters; this involved senior officers from all of the responding agencies. Additional helicopters were requested through the Aeronautical Rescue Coordination Centre (ARCC) at Kinloss in Scotland; the ARCC despatched 6 military Search and Rescue helicopters and coordinated the movement of all 11 helicopters involved during the incident response.

20 Fire and Rescue appliances were deployed, but the rescue operation was held back by water up to 9ft deep. The lifeboat crews attempted to check the cars being carried into the
harbour by the floodwater for occupants. People rescued by the helicopters were deposited at the village hall, which remained above the water level. The Ambulance Service maintained vehicles on standby, which included a Water Rescue Team. Police closed the main roads and drivers were urged to avoid the area. Dedicated Casualty Bureau phone lines were set up by the Police to allow concerned relatives and friends to make contact and help trace anyone unaccounted for. The utilities companies cut all power into the village, to prevent further accidents. Throughout the incident, the Environment Agency liaised with the emergency services at Gold Command and at the scene, advising them on the likely development of the flood situation.

By 6.00pm the floodwater had started to recede and the Fire service was able to gain access to properties and some stranded cars to carry out searches for people reported missing. By 8.00pm, the water level had receded to within the riverbanks; some cars had come to rest in the harbour, where they were buried by rubble. Flooded houses were filled with silt and debris carried by the floodwater.

Over 200 people were rescued - with around 100 being air lifted to safety; some people were taken to hospital with minor injuries. Many of those who were evacuated were taken to a temporary Rest Centre (set up in a nearby village that was unaffected by the flooding) whilst council staff assisted tourists who wished to return home. The Search and Rescue helicopters returned to base at 9.00pm and emergency service relief crews arrived to continue the Search and Rescue operation, which carried on overnight.

9.6 Continued search

There were still 16 people unaccounted for at 9.00am the following day; the continued search operation involved Police and Fire Services, the district council, HM Coastguard and RNLI. Specialist Fire Service Urban Search and Rescue teams and Police dog teams searched buildings and abandoned cars, whilst Police divers went into the harbour to check for bodies in the 50-60 cars washed there by the flood waters. The search operation continued until the emergency services were satisfied that everyone had been accounted for.

9.7 Recovery phase

On the 4th day after the flood, the lead coordination role was handed over from the Police to the local authority, which marked the end of the emergency. The flood had damaged buildings, roads and power supplies and sewerage had contaminated the floodwater, raising health concerns. Residents were moved into temporary accommodation while their flooded homes were dried out, assessed for damage by insurance companies and repaired.

The clean up operation not only involved residents and business owners but also the District and County Councils, Environment Agency, National Trust and other organisations. Fire crews remained at the scene for 7 days as part of the clean up operation and Police cordons were finally removed from the centre of the village after 11 days. The village’s infrastructure was restored: water supplies, sewers and telephone lines were repaired, the electricity substation replaced and damaged roads reinstated.
Figure 18 (in Appendix – Section 13) presents a detailed timeline of the flooding incident and the actions of the responding agencies.

9.8 Implications for Command Intent

The question of who was the commander of the incident does not have an obvious answer; whilst the Police eventually had overall strategic command through Gold Command, this facility was not up and running during the initial response period and the emergency services experienced some difficulty in reaching the town due to the weather conditions. A Coastguard Officer within the Maritime Rescue Coordination Centre (MRCC) at Falmouth assumed command of the Search and Rescue operation for the first two hours of the incident, whilst the Aeronautical Rescue Coordination Centre at RAF Kinloss directed the 11 helicopters involved in the operation.

In situations where multiple agencies are in charge of key aspects of the response there is the potential for them to develop different (i.e. conflicting) intent with regards to the resolution of the emergency and to issue orders that are at cross purposes. The Civil Contingencies Act, 2004, (discussed in Section 2.4.4) specifies the agencies that should be involved and their respective roles in the incident response; this scenario demonstrates that the multi-agency C2 structure needs to operate effectively even when there is no continuity of agencies across command levels and where resources are being used outside of their standard role.

9.9 Implications for Situation Awareness

The emergency services experienced significant problems in communicating with their control rooms and with each other; radio communication from Boscastle was not possible during the first few days due to poor coverage and only one mobile phone network was available in the area. This slowed the development and communication of an accurate understanding of the nature of the emergency across the responding agencies and led to a delay in initiating an appropriate level of response from all organisations. There was extensive media coverage of the incident, which was used by control room staff to develop an appreciation of the scale of the emergency; however, the lack of a single emergency service contact at the scene for the press meant that media reports were inconsistent and contained inaccuracies, which may have prejudiced the view of control room staff.

A failure to understand the wider situation and the activities of the other responding agencies would have severely hampered inter-agency coordination; despite the best efforts of the personnel at the scene, the overall strategic management of the combined multi-agency response during the first few hours has been described as ineffective (The South West Regional Resilience Forum, 2006).
10 Summary

The previous sections of this report present an analysis of command and control during multi-agency operations; from a research perspective, the incidents considered in this report are interesting because they are all ‘true’ multi-agency incidents, many of which required close coordination between agencies that are not used to working together. In addition, despite the successful resolution of all of the incidents, the scenarios described provide an insight into some of the potential difficulties associated with multi-agency emergency responses.

It is clear that during major incidents, all agencies are concentrating their efforts on resolving the emergency, but there are some problems that are inherent within the nature of the situation and of multi-agency operations. Returning to the aims of this work, the three issues that were of particular interest were:

- How does the context of the situation force responding agencies away from formal structures and procedures?
- How is command intent managed across ad hoc and fragmented systems?
- How could technology be used to support multi-agency operations?

10.1 How does the context of the situation force responding agencies away from formal structures and procedures?

Despite the severe restrictions imposed by the location, hazards and environmental conditions, the responding agencies in the scenarios discussed were able to coordinate their activities to produce an effective response. However, as a result of these restrictions - which were beyond their control - virtually everything else about the response had to be adapted in some way; from ad hoc alterations to organisational structures, to adaptation of procedures and the use of equipment. In order to meet the demands of an exceptional incident, conventional rules that are enshrined in Standard Operating Procedures (SOPs) might have to be circumvented or broken. This can result in a response that appears appropriate to the On-Scene Commander, but might lead to subsequent problems, e.g., misunderstandings with other agencies (or members of the same organisation) who are not aware that the Commander has gone ‘off-script’, or if there was a serious problem during the operation, then moving away from SOPs could make it difficult to defend certain decisions at a later enquiry.

10.2 How is Command Intent managed across ad hoc and fragmented systems?

The nature of Major Incidents (i.e. the high levels of uncertainty and multi-domain nature of the problem) requires effective communication and sharing of information between agencies, though awareness of even a ‘simple’ incident can vary widely and achieving
shared understanding across different organisations is labour intensive. This helps explain why common goals at the strategic level can still lead to different (conflicting) tactical and operational responses. Separate command structures may act as a barrier to cooperation, which is something that organisations attempt to overcome through the use of liaison roles and shared command facilities.

Improvised changes to command structures may be necessary to adapt to the constraints of the incident, but they may have unintended consequences in terms of continuity of command intent and situation awareness across organisations and levels of command. Different perspectives on the nature of the problem and the role of each agency in the response can lead to misinterpretation of intentions and a loss of trust across organisations. This may be due to a lack of experience of working together, which means an unfamiliarity with different agencies’ working practices, knowledge and requirements and potentially more fundamental questions over who is ‘in charge’ of the incident response. This lack of trust may well adversely impact on inter-agency cooperation during future multi-agency operations.

Each of the incidents considered in this report demonstrate how emergency response shares a number of features with the types of operations which may be supported by Network Enabled Capability (NEC):

- They involve a number of agencies that do not normally work together and individuals who did not know each other. Even when training has taken place between agencies, this does not always involve all of the agencies that might participate in a subsequent emergency response. This was particularly true of the Walham and Boscastle incidents and the issue of emergency preparedness through inter-agency training remains a serious issue;

- Groups were brought together at short notice to work on a specific task and were disbanded afterwards. This meant that there was often little opportunity for debriefing and sharing lessons learned (although the Boscastle flood has led to a number of important lessons learned reports via the Regional Resilience Forum, which provides some continuity across agencies);

- The different agencies work closely on joint tasks and share a very restricted physical and temporal space;

- Individuals in key positions are changed during the operation. For incidents with long time-scales this changing of personnel could be a matter of shift rotation to allow adequate rest breaks. For incidents that escalate in scale, this could be a matter of changing the level of seniority of the On-Scene Commander. In both cases, there is a need to maintain appropriate means of handing over command. At present, this would appear to depend very heavily on both the personality of the commanders involved in the handover (and one might anticipate this to be a much simpler issue for handing over to people within the same organisation than to people in different organisations) and on the ability of the outgoing commander to articulate not only the objective state of the current situation, but also their impressions and concerns regarding the operation to resolve it.
As such, it is possible to draw some conclusions from this incident and apply these more widely to multi-agency operations that share these features.

### 10.3 Incident command

Important considerations, such as the safety of the individuals working on an incident, clearly require that a single agency and Commander take responsibility. However, the Commander then becomes responsible for an incident that involves elements outside of their domain of expertise; given that the commander’s intent – what they want to happen – is formulated from their understanding of the situation, it is therefore vital that the other agencies involved provide the Commander with their own assessments of the incident, which the commander can take into account when making decisions. The other agencies involved then have to trust in the Commander’s decision-making abilities and know to raise with them any aspects of the incident that may be of relevance.

The incident at Walham shows that where agencies have not previously worked together, there may be more fundamental issues to address, such as differing perceptions as to who is in charge of the response. In the Search and Rescue examples, the definition of the On-Scene Commander can be problematic, e.g., it is not uncommon for several people, at the end of a rescue to believe that they were On-Scene Commander (but this is not possible as the role should be assumed by one individual). In the Boscastle floods, command was assumed by different agencies for different aspects of the response at different times during the incident. Within the domain of ‘operations other than war’, the armed services may find themselves working alongside local civil authorities, aid agencies and other Non-Governmental Organisations, all of whom may have very firm ideas concerning the purpose of an operation and who is in charge of it.

The military currently seem to avoid the problem of different services giving each other orders through the separation of tasks and the use of Liaison Officers where the ‘edges’ of the different organisations’ spheres of influence meet. Where separate command structures were combined during the response to Walham substation and the Boscastle flooding emergency, this was partly due to the use of Liaison Officers as a way of bridging the understanding of different agencies; this is evidently something that the military have known about for some time and their ad hoc use by other agencies demonstrates both the requirement for and the value of the role. As well as assisting in the development of shared understanding between agencies, Liaison Officers may also help to address some of the social issues discussed in this report, such as familiarity and trust. However, within NEC settings, where different forces may be acting within the same temporal and physical space and on shared tasks, the necessity to have one agency responsible for coordinating this activity is clear, in order to ensure that issues such as deconfliction are addressed and to prevent potentially lethal accidents.
10.4 Implications for organisational structures

The joint doctrine publication acknowledges that:

“...a multi-agency response to an emergency will require the integration of discrete command structures with different characteristics.”

(MoD, 2002b, p1-3).

Gloucestershire Constabulary Gold Command facility received glowing reviews from 43 Brigade’s JRLO and in his opinion it was instrumental in ensuring a common strategic approach across the agencies involved in the emergency.

Of the ‘blue light’ services, only the Fire and Rescue Service had a major presence at the Walham flood. However, it has been suggested that the GTEC facility (Gloucestershire TriService Emergency Centre) enabled closer coordination between the emergency services during the wider response to the Gloucestershire floods (Gloucestershire Constabulary, 2007). Whilst we have not looked in detail at the use of this facility, it has been argued that the adoption of a single control point for the three emergency services will have enhanced their coordination of resources during multi-agency incidents, in accordance with the aims of the Civil Contingencies Act (Gloucestershire Constabulary, 2004). Comparing this arrangement with the incident response to the terrorist attacks in London on 7th July 2005, where a combination of separate control centres and the failure to share information effectively contributed to delays in organising a coordinated tri-service response, it is possible to see why such claims may be made.

The use of such combined facilities as GTEC and Gold Command may be possible in a relatively static local emergency services setting; however for the military, where the theatre of operations could be a country or wider region of the world, it is not going to be practical to co-locate command facilities, especially where inter-agency cooperation may be on an ad hoc and unplanned basis. Therefore, ways to enhance cooperation that are not reliant on physical proximity or the merging of command structures must be found.

10.5 Civil Contingencies Act

Returning to the eight guiding principles for emergency response as defined in the Civil Contingencies Act 2004 (see Section 2), it is possible to summarise the findings of this report in relation to each one:

1. Direction – clarity of purpose defined by a strategic aim and objectives (i.e. Command Intent).

A common strategic aim may still translate into conflicting tasks and activities at the operational level, requiring the recognition of a single point of command across all organisations.
2. **Integration – effective and efficient co-ordination between agencies involved in the response.**

Coordination may be more or less effective at different levels of the multi-agency C2 structure and individual organisations’ goals, priorities and understanding of the situation may present a barrier to coordination.

3. **Subsidiarity – co-ordination occurs at the lowest appropriate level.**

Responding organisations each have unique organisational structures and work to different operational tempos, making effective coordination of activity difficult, especially where they are working on the same task, or are sharing the same physical or temporal space.

4. **Preparedness – all agencies, and their members, have clear understanding of their role and appropriate knowledge and abilities to undertake these roles.**

The constraints of an incident may force individuals and agencies to work outside of their standard roles and knowledge areas and to closely cooperate with new partners; this may lead to a level of uncertainty surrounding who is doing what and who knows what, which requires close coordination across agencies to resolve.

5. **Continuity – organisations should be able to employ Standard Operating Procedures such that their response to the emergency involves well-drilled activities, albeit at a greater tempo.**

Multi-agency operations may well involve groups and individuals who have never worked together before, are unfamiliar with each others’ practices and do not share a common language or set of procedures for dealing with an incident.

6. **Communication – reliable information is passed as efficiently as possible to all agencies who need it, including the public.**

There a number of barriers to effective communication of information, both within organisations and between them; communication is therefore not automatic and requires organisational structures, roles and technologies which support the sharing of information.

7. **Co-operation – agencies co-operate in a spirit of mutual trust and understanding.**

Where agencies are unfamiliar with each other’s work practices, misunderstandings and mistrust may result.
8. **Anticipation** – risk assessment and identification is performed in an ongoing manner in order to ascertain any possible changes in level of risk so that the response can be managed as appropriately and flexibly as possible.

As no single agency is likely to be in possession of all of the relevant facts about the incident, risk assessment is reliant on effective communication and cooperation between the responding agencies and an acknowledgement of the authority of the decision-maker.

The findings of this report indicate that multi-agency emergency response may not be as easy or straightforward as the Civil Contingencies Act envisages; whilst these eight guiding principles are entirely appropriate to the domain, our research has found that there are a number of social, organisational and technological barriers to coordination and cooperation between agencies and that these principles are unlikely to be achieved during all subsequent multi-agency Major Incidents until these problems are addressed.

### 10.6 Communities of Practice

The agencies involved in emergency response share a common interest in the successful resolution of the incident, but there can be problems relating to their various impressions of how best to tackle the problem and what the role of the various responding agencies was. A lack of familiarity of working together can mean that there may also be some difficulties with the sharing of information and the coordination of some tasks. The ideal emergency response ‘organisation’ could be seen as a community of practice. Communities of practice are described in terms of three elements: a common domain of interest; a community of members engaged in joint discussions and activities and who develop a shared practice, or common repertoire of resources (Wenger, McDermott and Snyder, 2002).

The notion of communities of practice has been used in management circles to describe natural associations of individuals that transcend organisational structures and teams and which are argued to bring a number of benefits to collaborative work, including knowledge transfer and retention, skill sharing and the development of trust. A community of practice can be measured according to their level of commitment on each of the three elements of domain, community and practice; the ‘community’ of responding organisations in emergency response could be said to have a high common commitment to the domain, but their commitment to the community might be lower (with some mistrust amongst agencies), as is the commitment to the practice (lack of common culture, experience and approaches to viewing the problem). If it were possible to nurture the development of communities of practice, then it would seem that this would be a sensible course of action to take with regards to multi-agency operations. However, these communities are thought to develop gradually over a period of time and so the question is how to develop the commitment to the domain, community and practice over a short period of time and with groups of individuals who may not know each other? This may be one area where networking technology could be used to try to augment social processes and speed up the development of the community of practice.
The term ‘having the bubble’ is used in literature on high reliability organisations, to describe the possession of a global understanding of what is going on, based on the assimilation and assessment of relevant information (Roberts and Rousseau, 1989); as such, it is very similar to the notion of Situation Awareness. Within high reliability or safety critical organisations, ‘having the bubble’ is seen as crucial, in order to avoid making decisions on the basis of incomplete information which could lead to catastrophic mistakes – for example the destruction of a commercial aircraft by the USS Vincennes in 1988 (Lintern and Naikar, 2002). While the Walham floods showed how much of the situation awareness was being held by one person, it is not clear who, if anyone, involved in the response to the Boscastle floods could have been described as ‘having the bubble’; whilst this lack of Situation Awareness and indeed shared awareness across agencies did not lead to any loss of life in this instance (mainly due to efforts of resources at the scene), it highlights the need to be able to rely on robust and flexible communications technologies, organisational structures and social networks in order to rapidly combine information and develop a shared understanding during multi-agency operations.

10.7 How could technology be used to support multi-agency operations?

One of the recommendations of our report on the response to the bomb attacks in London on 7th July 2005 was the development of a common operational picture (COP) between responding agencies. A COP is a single representation of relevant incident information that could be shared across service command centres during a multi-agency response (USJFCOM Glossary). It was suggested that recent moves to a TETRA-standard secure digital communications network (known as Airwave) by all of the emergency services would allow the creation of a COP, which could lead to faster and more appropriate joint service responses by reducing the level of uncertainty surrounding factors of the incident (listed in Section 2 of this report). In Search and Rescue, many (but not all) of the responding agencies have access to the EasyTask tasking system which can indicate who is responsible for specific functions. However, this might not provide detailed information on the progress of these functions, any problems that are being encountered, or additional information related to situation awareness. At present, much of this additional information is communicated in real-time via voice (providing agencies have access to the radio communications which, as we saw with the Boscastle floods, is not always guaranteed).

A COP might be useful during the emergency response incident, in order to share statements of intent amongst the responding agencies and to improve information sharing between the agencies. However, examination of the Walham incident response has illustrated the difficulty of developing a shared understanding of an incident, particularly between organisations that are not familiar with each other’s domains of expertise and work practices. This has implications for the development of a COP, as the presentation of information alone would appear insufficient to enable the development of a common understanding. Thus, one might instead argue for a Common Relevant Operational

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2 [www.jfcom.mil/about/glossary.htm](http://www.jfcom.mil/about/glossary.htm)
Picture (CROP), which presents information in the format familiar to specific agencies. This might require additional functions to ‘translate’ terms, concepts and procedures.

The question therefore becomes one of whether a COP or other networking technology can be used to facilitate the development of a common understanding. Given the important role played by Liaison Officers in bridging the gap between different organisations to allow them to work together effectively, it may be possible within a COP to support or further enhance this role, making the Liaison Officer the link between different layers of the operational picture.

The emergency responses covered in this report offer a number of caveats to the development of technology in support of multi-agency operations. First, where organisations did share an understanding of the situation, this tended to be as a result of intensive discussion and physical proximity; whilst networking technologies are able to support discussions, there may be a number of non-verbal social cues and processes that are lost in the move and having to call another person (compared to a face to face discussion in an open office or at an incident site) could become a further barrier to effective communication. Secondly, technology is only of use if it can be deployed effectively, in a timely manner and accessible to all agencies, e.g., at Walham, an earlier failure to deploy an Incident Command Vehicle left the Bronze Commander and Fire and Rescue staff unexpectedly having to make do with an impoverished and improvised set of command support tools; at Boscastle, the radio coverage meant that not all agencies could access the radio network (a similar situation can occur in mountain rescue operations); with the spread of Airwave across the emergency services in the UK, any agency who does not have access to this network might not be able to communicate easily with agencies on the network. Thirdly, and related to this latter point, the emergency response examples also showed the reluctance of the emergency services to share access to their encrypted digital communications, which they are very protective of, as access to this network in the wrong hands could be extremely damaging. The problem with this is how to develop a COP that can be implemented across agencies, without exposing them all to unacceptable levels of risk? This may be resolved through different levels of access, classification of information, or the use of layers to the COP; however, there is then a danger that it may cease to be a common picture at all. Fourthly, Liaison Officers played key roles in the scenarios discussed, enabling the successful combination of command structures, possibly by resolving some of the social issues we have identified. Historically, implementations of communications technology have failed to account for such social processes and accommodate them within the technological solution, with the result that the ‘improved’ process is actually less effective, for example in the case of the London Ambulance Service’s computer-aided despatch system (LASCAD) project failure.

Finally, the real difficulty in networking organisations will come in being able to rapidly enable the coordination of agencies that rarely, if ever, work together. As we have seen, it is the cooperation between these organisations which requires the most support and, during NEC operations, the likelihood is that (on the small scale at least) forces and commanders who have not worked together before will have to closely cooperate on a particular operation at short notice, only to subsequently be disbanded and re-combined with other agencies.
10.8 Sociotechnical Systems Approach

Our 2007 report into the response to the bomb attacks in London on 7th July 2005 concluded that the social networks that exist between cooperating organisations and the achievement of a common view of the situation were more important than the technology used to facilitate them. It went on to argue that a more sociotechnical systems view, i.e. the optimisation of both social and technical systems (Cherns, 1978; Clegg, 2000; Trist and Bamforth, 1951), should be taken during NEC design and implementation. The current research has shown that effective cooperation across agencies requires more than the sharing of information and that developing crucial shared understanding is a labour intensive process. The accounts presented here also highlight the necessity for command and control structures and technologies to be flexible, in order to accommodate the changing demands of unique situations and multi-agency associations; that the relevance of complex social issues, such as trust, to multi-agency operations is identified and that the unanticipated consequences of even small changes to command and control networks is recognized. We therefore hope that the reader would agree with us that the research presented in this report adds further weight to the viewpoint that, during development of networking technologies, there is a need to take the whole (social and technological) system into account.
11 Conclusions

This report presented an investigation of command and control during multi-agency operations, focusing specifically on military involvement in civil emergencies. The purpose of the current research was to identify:

- How does the context of the situation force responding agencies away from formal structures and procedures?
- How is command intent managed across ad hoc and fragmented systems?
- How could technology be used to support multi-agency operations?

The scenarios in this report illustrate four key aspects of multi-agency coordination, namely the formulation and communication of Command Intent, the Organisational Structures used to coordinate activity, Inter-agency Cooperation during the incident response and the development and maintenance of Shared Awareness within and across agencies.

Whilst the responses to the emergencies were successful, a number of adaptations to standard organisational structures, processes and procedures were necessary; some issues in terms of Shared Awareness and Inter-agency Cooperation were identified, which related to inexperience in working together, though which may also stem from a more fundamental question over the recognition of command authority.

This work follows on from an earlier report for Work Package 3.1.4, which examined the multi-agency response to the bomb attacks in London on 7th July 2005. That report suggested the development of a Common Operational Picture in order to improve the dissemination of incident information. Whilst this may bring some improvements, the current research suggests that the sharing of information alone is insufficient to result in a coordinated approach to an incident; a deeper, shared understanding of the relevant factors in the incident is required, though this is likely to be harder to support with networking technologies.

We also argue that effective coordination requires a high level of trust between responding organisations, as the ‘problem space’ is likely to extend beyond the expertise of any one group and they are reliant on each other’s expertise. This report supports the sociotechnical systems view of the implementation of NEC, i.e. that the development of networking technologies must also take account of the social processes that form an important component of command and control and inter-agency cooperation.
12 References

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13 Appendix

![Timeline](image)

**Incident Develops**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.00</td>
<td><strong>The Met Office</strong> forecast heavy downpours over the region through the day.</td>
</tr>
<tr>
<td></td>
<td><strong>Extreme rainfall</strong> begins in parts of north Cornwall.</td>
</tr>
<tr>
<td></td>
<td><strong>Rain gauges record torrential rainfall; flow in the river begins to increase.</strong></td>
</tr>
</tbody>
</table>

**Weather conditions**

**Local Authorities, Health bodies and Government Agencies**

- Environment Agency
  - Possible showers noted on weather radar.
  - Hourly monitoring of local rainfall begins.
  - Two Environment Agency operatives sent to check drains in the town.

**Members of the public**

**Emergency Services**

(Police, Fire, Ambulance, Coastguard)

**Military**

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Figure 18 - Flood scenario incident timeline (continues across pages 85-90)
<table>
<thead>
<tr>
<th>Time</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.00pm</td>
<td>After three hours of extreme rainfall, the river begins to spill over the north bank. Trees, silt and rocks are washed downstream and into the village. Extremely heavy rain results in water several inches deep collecting on local roads.</td>
</tr>
<tr>
<td>3.00pm</td>
<td>Main road bridge blocked by debris, causing water levels upstream to rise rapidly; Flood water 3 metres deep sweeps into the town.</td>
</tr>
<tr>
<td>4.00pm</td>
<td>Rising water floods local houses and a hotel. Debris carried by the flood water begin to demolish buildings in the town.</td>
</tr>
</tbody>
</table>

**Weather conditions**

- Environment Agency opens flood incident room at Bodmin

**Local Authorities, Health bodies and Government Agencies**

- Holidaymakers shelter from the rain in their cars.
- Rising water makes roads impassable and cars start to float. Some people begin to evacuate from their cars.
- People trapped by the rapidly rising flood water make their way to the roofs of buildings. Flood water reaches the guttering of buildings where people are sheltering.

**Members of the public**

- Fire Brigade receive their first calls: people trapped by rising flood water; Fire appliances are mobilised. Emergency services are hampered by flooded and blocked roads.
- Emergency Services close roads and Fire crews begin rescuing trapped residents. Lifeboats check cars carried by floodwater for occupants. Ground personnel guide RAF helicopters in to begin rescues.
- Cars start to be carried through village by floodwater

**Emergency services and other agencies**

- Auxiliary coastguard informs the Maritime Rescue Co-ordination Centre (MRCC) at Falmouth (HM Coastguard) of the situation. Coastguard Officer (within MRCC) assumes the role of Search and Rescue Mission Coordinator. HM Coastguard dispatch two Search and Rescue helicopters and two inshore lifeboats to the incident.
- The town Coastguard Rescue Team help to organise the rescue and evacuation of villagers.
- Rising flood levels force emergency services to pull back to a safe distance. Helicopter pilot reports that this is a Major Incident.

**Military**

- Helicopters arrive on scene
- A helicopter winches several families from the roof of a building.
<table>
<thead>
<tr>
<th>5.00pm</th>
<th>6.00pm</th>
<th>7.00pm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Major incident response</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Floods reach their peak; Cars are washed down from car park into the harbour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Floods start to recede.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slower-moving floodwaters deposit tons of silt inside buildings.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Some cars come to rest in the harbour, buried by several tonnes of rubble.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Local Authorities, etc.</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local hospitals put on standby.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>District Council provides emergency accommodation for evacuees.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environment Agency undertake emergency clearance work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Helicopters take uninjured rescued people to the village hall (which remained above flood level).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reports of people missing in floodwater lead Fire crews to begin searches of buildings and vehicles.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MRCC Falmouth updates the Police Control Room of the situation; fearing that hundreds of lives were at risk, the Police declare it a Major Incident.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gold Control is established at Police Headquarters, with representatives of the emergency services and other responding agencies in attendance. The public are urged to avoid the area and an emergency number is set up for those worried about friends and relatives.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Additional helicopters are requested from the Aeronautical Rescue Co-ordination Centre (ARCC) at Kinloss. 3 RAF and 2 Navy Helicopters are despatched to perform search and rescue, coordinated by ARCC.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Emergency Services (Police, Fire, Ambulance, Coastguard)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Helicopters check cars floating off shore for occupants.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Ambulance Service helicopters are dispatched; casualties are evacuated to Hospital.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Major incident response

<table>
<thead>
<tr>
<th>7.00pm</th>
<th>8.00pm</th>
<th>9.00pm</th>
</tr>
</thead>
</table>

Weather conditions

- Water levels recede back to within river banks.

Local Authorities, Health bodies and Government Agencies

- Environment Agency: deploy sandbags and pumping out of properties

Members of the public

- Displaced residents and tourists are taken to a temporary Rest Centre

Emergency Services (Police, Fire, Ambulance, Coastguard)

- Fire service relief crews arrive
- Helicopters start returning to base

Military

- The search and rescue operation continues throughout the night.
<table>
<thead>
<tr>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Search for casualties</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Local Authorities, Health bodies and Government Agencies</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Members of the public</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire resources – including specialist Urban Search and Rescue teams - engage in search operations.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HM Coastguard and RNLI assist with search.</td>
<td>Village still cordoned off by police 2 days later as buildings were assessed.</td>
<td></td>
</tr>
<tr>
<td>Emergency Services (Police, Fire, Ambulance, Coastguard)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Police divers are sent into the harbour to check the 50-60 cars washed away by the flash flood.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Military</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Day 5 onwards

Recovery Phase

Weather conditions

Local Authorities, Health bodies and Government Agencies

'Handover' of the lead co-ordination role from the police to the District Council marks the transition from the emergency phase to the recovery phase. The clean-up operation involves District and County Councils, Environment Agency, National Trust and others.

Members of the public

Residents move into temporary accommodation while their flooded homes are dried out and repaired. Twice daily briefings from Chief Executive of District Council to the public in the local hall.

Emergency Services (Police, Fire, Ambulance, Coastguard)

Day 11 Removal of Police Cordons. Village passed back to the community.

Military

- End of Document -