



National Audit Office

MINISTRY OF DEFENCE

Progress in Combat Identification

REPORT BY THE COMPTROLLER AND AUDITOR GENERAL | HC 936 Session 2005-2006 | 3 March 2006

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Progress in Combat Identification

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CONTENTS

SUMMARY	1
OPERATION TELIC	6
A number of casualties were caused by failures in combat identification	6
The Department has identified lessons	7
PROGRESS IN IMPLEMENTING THE PUBLIC ACCOUNTS COMMITTEE'S RECOMMENDATIONS	8
a) Progress in increasing the tempo of the Department's efforts in Combat Identification has been mixed	8
b) The Department has maintained its policy of minimising all casualties in conflicts including civilian casualties	12
c) The Department has further developed its international cooperation	13
d) The Department has taken steps to improve its collection of data on fratricide	14



APPENDICES

- | | | |
|---|---|----|
| 1 | Recommendations of the 2002 report by the Committee of Public Accounts on Combat Identification and the Government's response | 16 |
| 2 | Summary of Board of Inquiry Reports into Fratricide Incidents during Operation TELIC | 18 |
| 3 | Areas for improvement in Combat Identification incorporated into the Department's action plan after Operation TELIC | 21 |
| 4 | Examples of Major Equipment Programmes providing Situational Awareness and Target Identification Capability | 22 |
| 5 | Progress in Issuing and Ratifying NATO Standardisation Agreements for Combat Identification Systems | 26 |

- | | |
|-----------------|-----------|
| GLOSSARY | 27 |
|-----------------|-----------|

SUMMARY



Introduction

1 Combat identification is the way military personnel distinguish friend from foe and non-combatants during operations. It comprises a number of elements (summarised in **Figure 1**) and is a vital factor in the ability to win battles quickly and decisively and with minimum overall casualties. The Ministry of Defence (Department) defines Combat Identification as: “The process of combining situational awareness, target identification and specific tactics, techniques and procedures to increase operational effectiveness of weapons systems and reduce the incidence of casualties caused by friendly fire”.

2 Combat identification is complex and spans all the military environments (Land, Maritime and Air) and the interfaces between them. It is delivered through a mix of the elements identified in Figure 1. The Department’s planning assumption is that future operations will be predominantly conducted in coalition with allied and partner forces, making combat identification more complex, and calling for interoperability of equipment and harmonisation of tactics, techniques and procedures for Combat Identification. Changing operational threats and developments in technology also present challenges and opportunities to improve Combat Identification.

1 The elements of Combat Identification

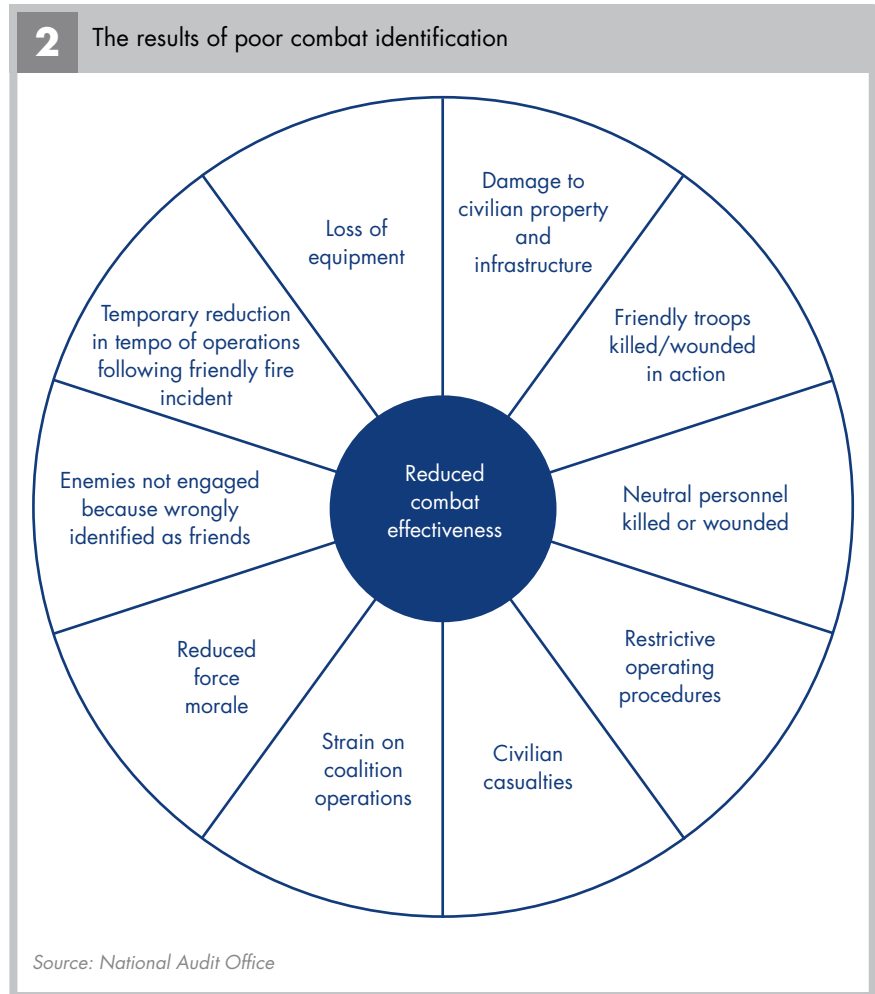
Combat Identification element	Definition
Situational awareness	aims to increase combat effectiveness by helping military personnel gain a better understanding of the environment – the battlespace – in which they are operating. ¹ This is achieved by providing timely and accurate information. It comprises intelligence and identification information from a range of sources.
Target identification	aims to identify, to a high degree of confidence, all contacts (people and vehicles) in the Joint Operations Area ² to assess whether they are friend or unknown. A number of devices are used to identify possible targets including “Question and Answer” systems such as Identification Friend or Foe transponders, or electro-optical/infrared devices.
Tactics, techniques and procedures	aim to guide behaviour in operations and when followed by military personnel improve target identification and situational awareness, when applied with the range of technical solutions available. They are developed by either individual Services – Army, Royal Navy and Royal Air Force – or jointly. They evolve from military doctrine or lessons learned in operations. Training is key to ensuring that the tactics, techniques and procedures are correctly implemented.

Source: National Audit Office

¹ There are three environments – Land/Ground, Air, and Maritime.

² A temporary area defined by a NATO strategic or regional commander, in which a designated joint commander plans and executes a specific mission at the operational level of war.

3 The Department must balance its Combat Identification needs with other demands on the Defence budget. Research and spending on Combat Identification to date has focused on procuring a range of technologies to improve situational awareness, providing target identification at the point of fire and developing tactics, techniques and procedures. There has also been a growing appreciation of the importance of human factors in Combat Identification. As **Figure 2** shows, poor Combat Identification can have a range of implications.



4 Our report on Combat Identification³ published in 2002 examined whether the Department had developed an approach to Combat Identification that minimised the risk of fratricide⁴ alongside the need to maintain or improve combat effectiveness. The Committee of Public Accounts subsequently reported in August 2002.⁵ The main conclusions and recommendations of the Committee are summarised below:

- The Department needs to increase the tempo of its efforts.
- The Department needs to provide a clearer account than it has done so far of the steps it is taking to reduce the risk of civilian casualties and when these measures will be in place.
- The Department needs to develop the existing methods of co-operation with allies to address these additional risks.
- The Department should produce a database on the level of fratricide, and ensure that the information gathered is robustly analysed and disseminated appropriately within the United Kingdom and to coalition partners.

The Committee's recommendations and the Government response⁶ are shown in Appendix 1.

5 As our 2002 report stated: "History shows that fratricide appears to be an inevitable risk in warfare". During the combat phase of Operation TELIC in Iraq⁷, there were a number of deaths of UK servicemen apparently as a result of failures in Combat Identification. The Chairman of the Public Accounts Committee asked us to conduct an assessment of the Department's progress in delivering Combat Identification capability, including lessons learned from recent operations. We carried out this assessment through extensive interviews, examination of reviews and research conducted by the Department and file review.

3 Ministry of Defence: Combat Identification, HC 661 2001-02.

4 The Department defines fratricide as: "The accidental death or injury which occurs when friendly forces engage their own forces, believing either them, or their location to be an enemy target". This definition does not include so called "friendly fire incidents" resulting from accidents.

5 Committee of Public Accounts: Fifty-Sixth Report HC 759 2001-2002.

6 Treasury Minute in reply to the above PAC Report: Combat Identification Cm 5636 October 2002.

7 Operation TELIC is the name given to the UK military operation in Iraq which began in March 2003.



RECOMMENDATIONS

6 Our review showed that, in the light of the Committee recommendations and experiences during Operation TELIC, the Department had identified a number of areas where it can achieve better Combat Identification performance. It has made progress in developing policy and tactics, techniques and procedures, improving data collection, giving greater recognition to human factors through, for example, new training courses, and developing solutions with some new equipment fielded for Operation TELIC. However, there is more that the Department could do. Our specific recommendations are:

Recommendation 1

The Department should continue and complete the actions recommended by the Public Accounts Committee and accepted by the Government and pursue the lessons identified from Operation TELIC. It should do so with particular reference to recommendations 2, 3 and 4 below.

Recommendation 2

When the current review of Combat Identification policy is completed, the Department should develop a strategy for its implementation of the revised policy. The strategy should include required actions, responsibilities for such actions, risks, desired outcomes and associated benefits with a realistic benefits realisation plan and an outline timetable for implementation. This strategy should encourage greater coherence in delivering Combat Identification capabilities and promote better understanding amongst stakeholders.



Recommendation 3

The Department should continue to focus on gaining agreement between principal allies on compatible technology and tactics, techniques and procedures to improve future coalition Combat Identification capability. If allies do not make timely decisions, the Department should consider carefully the likely costs and benefits of proceeding with United Kingdom specific solutions. In particular, the Department should continue to consider the advantages of an incremental acquisition of the appropriate technology balanced with investing in further work on training, tactics, techniques and procedures. This work will stretch and test the operation of the Senior Responsible Owner⁸ concept.

Recommendation 4

The Department should further improve its management of the collation and analysis of fratricide data. The management should include the provision of central responsibility for oversight of research and co-ordinating available data and analyses of fratricide incidents in operations. Collating and analysing fratricide data in this way should help inform the development of Combat Identification capability.

⁸ The Senior Responsible Owner is personally accountable for ensuring that a project or programme of change meets the objectives and delivers the projected benefits and for managing the risks.

OPERATION TELIC

7 This section of the Report discusses fratricides that occurred during Operation TELIC and areas for improvement in Combat Identification identified during the Operation.

A number of casualties were caused by failures in combat identification

8 During the combat phase of Operation TELIC (18 March to 1 May 2003) there were six deaths of United Kingdom servicemen from suspected fratricide, in four separate incidents. Information on all fatalities during this phase of the operation is given in **Figure 3**. There have been no further fratricides in the later stages of Operation TELIC.

9 The Department estimates that between 25 and 35 servicemen were wounded as a result of actions by United Kingdom or other allied forces but it is not possible to give an absolute figure because of uncertainty over causes. The following paragraphs examine the progress which the Department has made in examining the four incidents and how Combat Identification failures contributed to them and the lessons identified.

The incidents were investigated by Boards of Inquiry

10 Serious military incidents, including deaths from suspected fratricide, are examined by Boards of Inquiry which investigate the circumstances of the incident and recommend measures to minimise the risk of similar incidents occurring in the future. Each Service has its own procedures for running a Board of Inquiry. The Department considered designating a single focal point for identifying Combat Identification lessons from the incidents but concluded that the benefits could be realised without such an additional appointment.

3 Fatalities during the combat phase of Operation TELIC

Fratricides	6
Killed by enemy action	6
Disease and Non battle injury/Killed on active service	21
Total fatalities	33

Source: National Audit Office

11 **Figure 4** summarises the progress of the four Boards of Inquiry into the Operation TELIC fratricide incidents in the three years since the incidents occurred.⁹ The Boards of Inquiry found that, although technical factors were present (for example Combat Identification equipment apparently not working properly in the case of the Tornado/Patriot incident), there were also other factors such as failures in communication and procedures (such as airspace routing and control) and issues related to the way doctrine is developed and training conducted in allied and United Kingdom forces.

12 Board of Inquiry reports are internal documents with restricted availability. However, following a recommendation from the House of Commons Defence Committee, the Department agreed to make available to Parliament summaries of Board of Inquiry reports into the Operation TELIC fratricide incidents once all other related proceedings are completed. All the reports have now been made public.

9 Since June 2004, it has been the Department's policy that a Board of Inquiry into unnatural deaths and serious injuries must convene within 48 hours of an incident. There is no set duration for a Board of Inquiry, and the length of time an inquiry takes will be largely determined by the complexity of the case. In particular, external factors such as police and technical investigations, investigations by allies, Coroners' Courts and legal action by the victim or next of kin can delay a Board of Inquiry. It is the Department's intention to try to conclude inquiries within 14 weeks of an incident.

4 Progress on Boards of Inquiry into Deaths from Suspected Fratricide during Operation TELIC

Date of incident	Environment	Details of incident	Progress on Board of Inquiry	Elapsed time between Incident and Board of Inquiry report
23 March 2003	Ground to air	United States of America Patriot surface to air missile shot down an RAF Tornado. Two United Kingdom aircrew killed.	Completed. Made publicly available in May 2004.	14 months
25 March 2003	Ground to ground	British Challenger 2 tank engaged second Challenger 2 outside Basra. Two soldiers killed and two wounded.	Completed. Made publicly available in January 2006.	28 months
28 March 2003	Air to ground	United States of America Air Force A10 ground attack aircraft mistakenly engaged a British Combat Vehicle, resulting in the death of one soldier and three wounded.	Completed. Made publicly available in January 2006.	14 months
30 March 2003	Maritime	British marine killed when his landing craft came under fire from rockets and small arms fire.	Completed. Made publicly available in February 2006.	8 months

Source: National Audit Office

NOTE

A summary of the findings of the Boards of Inquiry is at Appendix 2.

The Department has identified lessons

13 Against the background of fratricide incidents during Operation TELIC, the Department carried out a review of progress in resolving Combat Identification issues. The review focused on the ground to ground and air to ground environments which were assessed as priority. The key conclusion was that, because incidents of fratricide had occurred, there was more to do to deliver improved Combat Identification. Whilst no major new initiatives were needed, a number of areas for improvement were incorporated into the Department's Combat Identification action plan (See Appendix 3 for details).

PROGRESS IN IMPLEMENTING THE PUBLIC ACCOUNTS COMMITTEE'S RECOMMENDATIONS

a) Progress in increasing the tempo of the Department's efforts in Combat Identification has been mixed

PAC Recommendation: The Government needs to increase the tempo of its efforts

Government Response: The Department drew attention to the considerable amount of work already underway. It confirmed that work will be taken forward vigorously and the Department will continue to review and update Combat Identification capability as the threat evolves. Investment is being made on a range of assets including in the Successor Friend or Foe Systems for 38 platforms; and in Bowman.

14 The following paragraphs examine the progress the Department has made since Operation TELIC. Our conclusions are:

- Progress on a range of equipment projects that contribute to improved situational awareness and target identification involving a significant funding commitment has varied (paragraphs 15 to 21).
- The Department has made progress in developing doctrine and tactics, techniques and procedures (paragraphs 22 to 25).
- Greater emphasis is being placed on understanding how Human Factors influence successful Combat Identification (paragraphs 26 to 28),
- The Department is reviewing its high level Combat Identification policy (paragraphs 29 to 30).
- Changes have been introduced to the Department's structures to improve the management of the delivery of Combat Identification (paragraphs 31 to 34).

Progress on a range of equipment projects that contribute to improved situational awareness and target identification involving a significant funding commitment has varied

15 Following the Committee of Public Account's examination of Combat Identification in April 2002, the Department provided the Committee with an illustrative list of equipment projects and other initiatives intended to improve Combat Identification. Appendix 4 provides details of these projects and other examples of current major equipment projects providing Situational Awareness and Target Identification capability. It highlights the significant funding levels being committed to delivering Combat Identification solutions. Notably, the Department has already made firm investment decisions worth £3.8 billion on projects containing elements of Combat Identification.

16 **Figure 5** summarises the progress on certain equipment projects since we last reported in 2002. It highlights that, while progress has been made in the Air and Maritime environments, the pace of development of solutions in the Department's priority Ground and Air to Ground environments reflects the more challenging environment.

17 The main equipment based project to improve target identification on the ground is the Battlefield Target Identification System although the specific technical solution for this system has yet to be decided. While other equipment projects such as Bowman and the Coalition Blue Force Situational Awareness Demonstrator will help military personnel gain a better understanding of the whereabouts of people and equipment (situational awareness), until the Battlefield Target Identification System is delivered, soldiers and aircrew will continue to rely largely on visual recognition of enemy and friendly forces and identification of friendly vehicles through devices such as thermal identification panels and infra red beacons which visually mark vehicles as "friendly".

5

Status of equipment projects contributing to Combat Identification

Status	Project
Good progress	Successor Identification Friend or Foe programme (Target identification in Air environment) Link 16 (Situational Awareness in the Air/Maritime environments) ASTOR (Theatre surveillance and target acquisition system) Coalition Blue Force Situational Awareness Demonstrator (Land situational awareness)
Deferred	Battlefield Target Identification System (Land target identification)
Deferred and re-scoped	Co-operative Engagement Capability (Maritime situational awareness)
Re-scoped	Ground Based Air Defence Phase 1 (now called LEAPP and contributing to ground to air target identification)
Delayed	Bowman/Combat Infrastructure Platform (situational awareness primarily in the Land environment). We will publish a report examining progress on Bowman in more detail later in 2006.
Cancelled	ASTRID (a target Identification system for the air to ground environment)

Source: National Audit Office

18 It is important that the Battlefield Target Identification System is inter-operable with allies, particularly the United States. Ensuring this inter-operability has led to slow progress in the project. While NATO issued a Standardisation Agreement in June 2000 and the Department successfully trialled a compliant solution (Battlefield Target Identification Device) in September 2001, the project was deferred in 2003 when allies and partners agreed to a United States proposal to assess technologies other than those defined in the NATO Standard Agreement.

19 In December 2004, the Department revised the scope of the Battlefield Target Identification System requirement. The Department's Equipment Plan includes an assumption of a minimum of one Brigade to be equipped with a ground to ground target identification device (target date for delivery end of this decade) and ground target identification for Attack Helicopters and offensive fast aircraft (target dates

for delivery early in the next decade). Funding priority will be established through a standard Departmental balance of investment procedure.

20 A key activity which will inform both the Department's and allies' decisions on future investments is the Coalition Combat Identification Advanced Concept Technology Demonstration. This is a four year programme including trials and exercises, the final element of which was Exercise URGENT QUEST on Salisbury Plain in September and October 2005. This exercise involved allies from eight allied nations and Sweden and tested a range of potential technologies for ground to ground and air to ground target identification. The Department has assessed the results of Exercise URGENT QUEST and its analysis together with those of the participants is due to be published in February 2006. The overall Demonstration assessment is due to conclude in Summer 2006.

Important decisions on the Battlefield Target Identification System are due to be made in Summer 2006

21 The Department deferred decisions on the Battlefield Target Identification System from February 2005 to Summer 2006 to ensure that the full range of potential solutions could be considered, that the levels of technical maturity were right, that the scope for international coherence was optimised and that the best balance of new equipment acquisition with better tactics, techniques and procedures to meet the requirement was understood. This deferment will enable the Department to take into account the results of the Demonstration. A technical solution other than the Battlefield Target Identification Device may be adopted which could affect the project's affordability and timetable.

The Department has made progress in developing doctrine and tactics, techniques and procedures

22 Military doctrine comprises a series of publications that stipulate how the Armed Forces should be deployed, employed and recovered from operations. In November 2004 the Department published "Combat Identification in Support of Joint Operations" to assist the Joint Task Force Commander and his staff involved with planning future joint operations. So far the United Kingdom is the only nation to have produced a formal publication summarising Joint Combat Identification doctrine. The Department plans to begin to review this doctrine in Spring 2006 and will take into account findings of the Demonstration.

23 Identifying shortfalls in tactics, techniques and procedures for Combat Identification (which are developed from doctrine and lessons identified during operations and training) has proved difficult because past exercises and operational lessons identified papers have produced insufficient data on which to draw conclusions about Combat Identification. To address this shortcoming, Combat Identification objectives are being incorporated in exercises and individual Services have taken initiatives to improve the links between identifying Combat Identification lessons and development of doctrine and tactics, techniques and procedures. For example, the Army now captures information from exercises on incidents that would probably be fratricide in warfare (and near misses) and has reviewed its Combat Identification doctrine and training, tactics and procedures.

24 In October 2004 the Department completed a review of Combat Identification training. Processes are now in place to ensure that Combat Identification is treated clearly in all doctrine and training. Combat Identification doctrine has been incorporated in relevant publications and regulations and all Army Field manuals are being updated. The "through career" fratricide awareness training package is complete and has been introduced into the training syllabus of all Army Basic Training Units and officer training at Sandhurst from September 2005. In the Navy, formal Combat Identification lessons have been introduced at Senior and Junior levels in maritime training schools. For Air Warfare training new Battle Space Management courses (part of tactics, techniques and procedures) have been introduced.

25 The Department is either investing or plans to invest in new systems to improve Battle Space Management and hence Combat Identification. The Joint Air Land Organisation has been established to provide improved integration of air and land operations.

Greater emphasis is being placed on understanding how human factors influence successful Combat Identification

26 In 2003, the Department completed a two year programme of research into the way human factors influence the success of Combat Identification. The research concluded that it is crucial to consider the root causes of fratricide at all levels of organisation – tactical, operational, strategic and political. It also highlighted the value of training to enhance skills and knowledge and to improve awareness of the causes of fratricide and possible reduction measures. It recommended a number of tools which could be used to reduce the risk of fratricide. Many of the methods – such as an incident causality checklist to analyse the causes of "fratricide" in exercises, Combat Identification aides-memoires and training packages – have already been adopted by the Department.

27 In common with the maritime and air environments, Combat Identification aides-memoires for soldiers and commanders for use in the land environment were developed and these have been issued to troops in training establishments and on operations. The aide-memoire cards aimed to raise awareness of Combat Identification. Although 60,000 aide-memoire cards were printed and transported to theatre for distribution to soldiers in Operation TELIC, supply and asset tracking problems meant they were not distributed for the warfighting phase. As they were intended to address the human element in Combat Identification decisions, it is extremely difficult to know whether or not they would have made a difference in the two cases of United Kingdom fratricide where they might have applied.

28 To be able to identify enemy and friendly forces visually is central to successful combat identification and the Department routinely provides recognition training. One of the lessons identified following the warfighting phases of Operation TELIC was that the existing recognition training needed to be improved. Accordingly, in March 2004, the Department agreed a policy on Visual Recognition Training and identified a requirement for a computerised Joint Recognition Trainer. This is now included in the Equipment Plan in 2008-09 which will allow for full understanding of the requirement and consideration of the range of solutions available. In the interim, Fleet Command is trialling a commercial recognition training system costing some £30,000. A potential NATO system was also trialled during Exercise URGENT QUEST in September and October 2005.

The Department is reviewing its high level Combat Identification policy

29 The 2001 Combat Identification policy identified three broad priority areas for future work:

- The production of standards and a framework for the delivery of a coherent, integrated Combat Identification equipment programme, and the development of technical solutions to current Combat Identification problems.
- The full exploitation of current Combat Identification capability through improved Battlespace Management in joint and multinational operations.

- The development of joint doctrine; co-ordination of single service doctrine and improvements to current Tactics, Techniques and Procedures.

30 The Department's policy is currently being reviewed with the aim of issuing revised policy in Spring 2006. The revised policy will take account of recent developments to the Department's governance structure, development of human factors work and the Law of Armed Conflict.

Changes have been introduced to the Department's structures to improve the management of the delivery of Combat Identification

31 Delivery of Combat Identification is a difficult and demanding task, requiring strong direction. The organisational structures put in place in 2001 helped bring together a wide range of stakeholders within the Department and have improved understanding of issues and the exchange of information. However, there remained a risk that issues affecting the coherent delivery of all aspects of Combat Identification were not being considered at a sufficiently strategic level. Recognising the challenges, in April 2004, the Department appointed a Senior Responsible Owner for Combat Identification¹⁰ who is directly responsible to the Defence Management Board¹¹ for:

- the co-ordinated delivery of all aspects of the Combat Identification;
- defining success criteria and benefits against which performance would be assessed; and
- ensuring that the Combat Identification helps enable military personnel to distinguish friend from foe and civilians during operations thus enhancing the ability to win battles quickly and decisively with minimum overall casualties.

¹⁰ He is the Capability Manager (Information Superiority) and is based in the Equipment Capability Customer area and represents the customer in the procurement of military information and intelligence systems.

¹¹ The senior management board of the Ministry of Defence.

32 Given that the Capability Manager (Information Superiority) is responsible for the technologies that pass information around the battlespace and represents the customer in the procurement of military information and intelligence systems, the Department believes that this post is best placed to carry out the Senior Responsible Owner role. The Senior Responsible Owner has the authority of the Defence Management Board to direct work in support of delivering improvements to Combat Identification capability and he is empowered to represent Combat Identification requirements and issues in all Departmental fora, including those dealing with resource allocation. The Department believes that he does not need formal direct line management responsibility or budgetary responsibility for Combat Identification. He works by leading, co-ordinating and focusing the relevant activities in the Department and acting as an advocate for the capability within the Department.

Allocation of resources to Combat Identification involves complex judgements

33 Combat Identification cannot be delivered as a single equipment programme but only as an integrated combination of many equipment programmes (see Appendix 4 for examples) and by other means such as training, tactics, techniques and procedures. Overall spending on Combat Identification is part of wider Defence spending and it is difficult to identify separately. Allocation of resources is, therefore, a complex issue. The Senior Responsible Owner represents the need for Combat Identification in the overall balance of investment judgements made collectively in the course of the planning process.¹²

34 To address the difficulties in making judgements on funding Combat Identification, the Department's Defence Science and Technology Laboratory is developing a model of the Combat Identification process. It should help to determine the value of Combat Identification solutions to improving combat effectiveness. The initial stage in April 2005 involved capturing the range of human, operational and physical factors that affect Combat Identification, and the building of a prototype model to represent the Land environment. Full quantification of the impact of the various factors on Combat Identification will be possible once the operation of the model has

been validated against data collected from live exercises and synthetic environments. The Department intends to use the model to help inform decisions on the Battlefield Target Identification System in 2006. As the model is not fully validated, it was necessary to use military judgement to provide inputs to the modelling process and provide assumptions about aspects of human behaviour.¹³

b) The Department has maintained its policy of minimising all casualties in conflicts including civilian casualties

PAC Recommendation: the Department needs to provide a clearer account of its steps to reduce civilian casualties

Government Response: Effective Combat Identification will help reduce civilian casualties

35 The Committee found that the absence of effective Combat Identification can increase the risk of civilian casualties in conflicts. In addition, public concern about civilian casualties may affect the willingness of the public to support future operations.

36 The Department responded that it aims to minimise all casualties on the battlefield by improving combat effectiveness by, among other things, using effective Combat Identification. The issue of identifying non-combatants can be addressed, for example, with tactics, techniques and procedures by assessing the behaviour of a potential target to see if it is consistent with military activity, and through situational awareness. The steps being taken will increase operational efficiency and enable our forces to make better judgements about the presence and location of non-combatants on the battlefield, thus reducing the risk of civilian casualties. Improved situational awareness in complex land environments provided by systems such as BOWMAN from 2004 will be particularly relevant.

37 In 2004, the Department's policy on use of force within armed conflict and operations was updated and its main points are shown in **Figure 6**.

¹² The Senior Responsible Owner is, however, responsible for some research projects on Combat Identification.

¹³ Military Judgement Panels are formed of officers from the Army, Royal Navy and RAF and use their knowledge and experience to provide a judgement about certain situations.

6 The policy on the use of force within armed conflict and operations

- The key elements of the Law of Armed Conflict are based on customary international law and international agreements.
- Attacks are only directed against military objectives.
- All feasible precautions are to be taken in the choice and methods of attack with a view to avoiding, and in any event to minimising incidental loss of civilian life, injury to civilians and damage to civilian objects.
- Indiscriminate attacks are prohibited. Indiscriminate attacks are defined as those that strike military objectives and civilians, or civilian objects, without distinction.
- An attack will be disproportionate if it is expected to cause incidental loss of civilian life, damage to civilian objects or a combination thereof, which would be excessive in relation to the concrete and direct military advantage anticipated.
- If there is a choice between targets for obtaining a similar military advantage, the target that offers least risk to civilians, and civilian objects is to be attacked.

Source: The Ministry of Defence

c) The Department has further developed its international cooperation

PAC Recommendation: The Department needs to develop the existing methods of international cooperation

Government Response: The Department has considerable experience of military operations with allies and planning for such operations takes into account the need to establish robust procedures at an early stage. Such arrangements will continue to be developed for any future joint and combined operations.

38 The Committee reported that most future military operations that our armed forces will undertake are likely to be in coalition with allies, which complicates Combat Identification and increases the risks of fratricide. Our analysis found that operations with allies continue to present challenges to achieving Combat Identification (paragraphs 39 to 43).

Operations with allies will continue to present challenges to achieving Combat Identification

39 The United Kingdom expects to conduct most future military operations in partnership with allies, in particular, with the United States of America. Operating as part of a coalition increases the difficulty of achieving effective Combat Identification. During Operation TELIC, United States liaison and fire control teams were integrated with the United Kingdom 16 Air Assault Brigade to provide better co-ordination of United States aircraft delivering Close Air Support to United Kingdom ground troops. Achieving effective Combat Identification will require more joint and coalition training and the timely agreement of appropriate tactics, techniques and procedures for military personnel to follow.

40 NATO is key to helping ensure that allies' Combat Identification equipment can function effectively together. Coalition partners agreed to use some capabilities based on NATO standards in coalition operations. For example, during Operation TELIC the fitting of appropriate target friend or foe identification equipment to coalition aircraft and Combat Identification Panels and Thermal Identification Panels to coalition vehicles based on NATO standards agreed by coalition partners. The Department procured and leased some equipment as Urgent Operational Requirements to enable our Armed Forces to operate effectively with United States Armed Forces.

Progress has been made in developing international frameworks for Combat Identification

41 To ensure that the Combat Identification systems of our own Armed Forces and partners can function effectively together, Combat Identification systems should be developed to comply with agreed national and international standards. When we last reported in 2002, the Department was still developing its high level frameworks for Combat Identification. The framework was being developed in two phases and was due to be completed by September 2004.

42 Phase 1 reported in March 2002 and assessed the capabilities and shortfalls of existing Combat Identification systems and recommended how a future framework for Combat Identification should be developed. This Phase concluded that current Combat Identification systems were focused on individual equipment, vehicles and environments and had a number of capability gaps. In addition, it found that Combat Identification systems were not all able to work effectively in one Service, across the Services or with coalition partners. Phase 2 of the project was suspended in 2003, while work to align a United Kingdom framework with emerging United States and NATO frameworks was finalised. An outline United Kingdom Combat Identification framework covering the ground to ground and air to ground environments was subsequently produced in May 2005 and the final framework is now expected to be delivered in Spring 2006.

43 The Department has played a full role in the development of a number of NATO programmes. In 1999, NATO initiated a policy to bring all member nations up to the same level of Combat Identification capability. To achieve this objective, NATO is continuing to develop:

- **a Combat Identification strategy.** An initial version of the strategy was issued in 2003 and NATO is now working on a plan to support the implementation of the strategy. The aim is to have an endorsed strategy in 2006.
- **a common Combat Identification architecture.**¹⁴ This work is being led by the NATO Identification Systems Co-ordinating Office. Our 2002 Report noted that development had been slow, partly due to lack of resources in the Office, and partly because of the difficulty of securing the agreement of the many member nations. The Office has remained short of resources (it has only two permanent staff currently). A first edition of Architecture for Combat Identification was delivered in January 2005, some three years later than planned and should provide a benchmark against which NATO members can assess their existing capabilities and deficiencies in Combat Identification.

- **Standardisation Agreements.** Appendix 5 shows the detailed progress made on these agreements since we last reported. In the short term, NATO has focused on implementing the Agreements for Combat Identification solutions in Battlefield Target Identification, improved air systems, Identification Friend or Foe equipment and on how best to combine data gathered across all operational environments.

d) The Department has taken steps to improve its collection of data on fratricide

PAC Recommendation: The Department should produce a database on the level of fratricide and ensure that the information gathered is robustly analysed and disseminated appropriately within the United Kingdom and to coalition partners.

Government Response: The Department has put in place mechanisms to gather information on Combat Identification effectiveness during training exercises.

44 The Committee found that the Department possessed a dearth of data on the level of fratricide from past operations and exercises, and undertook limited analysis of the data that was available. In addition to recommending that the Department produces a database of the level of fratricide, the PAC also recommended that the Department should ensure that the information gathered is robustly analysed and disseminated appropriately within the United Kingdom and to coalition partners. Our analysis found that:

- The Department has developed its analysis and collation of data on fratricide incidents (paragraphs 45 to 47).
- Improvements are being made to the collection and analysis of data from training and simulations (paragraph 48).
- Steps have been taken to clarify responsibilities for the collation of information on fratricide (paragraph 49).

14 Systems and interconnections supporting Combat Identification.

The Department has developed its analysis and collation of data on fratricide incidents

45 The capture and thorough analysis of all incidents of misidentification leading to fratricide or near misses, whether they occur in training, exercises, simulations, or operations, is key to understanding Combat Identification challenges. As we reported in 2002, there is no national or internationally accepted approach to collating fratricide data and the reporting and analysis of fratricide data has historically been very limited. Estimates of fratricide rates and identification of trends have therefore needed to be treated with caution. At the time of our 2002 Report we found that “History shows that fratricide appears to be an inevitable risk in warfare. It has for many years accounted for between 10 and 15 per cent of friendly casualties during operations”.

46 Recently there have been a number of systematic attempts to compile records of fratricides and to identify causal factors. Notably, the Department used its Defence Science and Technology Laboratory to develop a database of fratricide incidents in operations worldwide which represents the best source of available evidence. This database has drawn on data for events since 1950. To develop the database further, the Laboratory is examining what international data exists on fratricide and has held a workshop with coalition partners to discuss how fratricide data is collected and analysed and the benefits of sharing data. The recommendations of the workshop should be known by Summer 2006. The Department is also undertaking analyses based on its internal records and historical data. Analyses, drawing on the latest available estimates, suggest that fratricide continues to be a feature of modern operations.

47 The Committee recommended that the Department should collate, analyse, and disseminate data on fratricide in joint and coalition operations and major exercises. In 2004, in the context of reviewing the likely effectiveness of a Battlefield Target Identification System on fratricide rates, the Department carried out some analysis using the fratricide database discussed above. This confirmed that for Operation GRANBY¹⁵ there were nine deaths from fratricide in one allied air to ground incident. For Operation TELIC there were six deaths from fratricide – three caused by United Kingdom fire and three from allied fire in four separate incidents. During Operations TELIC and GRANBY, there were 30 United Kingdom deaths caused by enemy action.

Improvements are being made to the collection and analysis of data from training and simulations

48 Although training and simulations cannot fully replicate actual combat conditions, data from these sources can still provide useful insights and lessons. In 2003, as part of the Human Factors studies the Department reviewed how incidents of misidentification during training and operations were recorded and analysed and whether processes for initiating changes to Combat Identification were effective. As a result of weaknesses identified by the study, the Department has introduced improved procedures for recording incidents occurring during training using standard report forms and each Service is developing a database to record Combat Identification incidents. For example, the Army has recently begun using a new Tactical Engagement Simulator to capture quantitative and qualitative data from training exercises. So far there has not been enough time to record sufficient data in the databases to identify trends.

Steps have been taken to clarify responsibilities for the collation of information on fratricide

49 Until recently, collection and analysis of fratricide data was being undertaken in a number of areas both within the Department and among our allies. They have not had access to, or incorporated all of, the available data and there are differences between their data on the same conflicts. The Department has recently identified a single repository for investigations of operational fratricide incidents and for holding the data generated. The Senior Responsible Owner is content that this single source of operational data will be sufficient for use by his team and others. The Department believes that data on “fratricides” on exercises does not have the same status for analysis but will continue to be collected and used appropriately by the Army, Navy and Air Force.

¹⁵ Operation GRANBY was the UK name for the coalition campaign which led to the liberation of Kuwait in 1991. Some 53,000 British Service personnel took part in this conflict, from all three Services.

APPENDIX 1

Recommendations of the 2002 report by the Committee of Public Accounts on Combat Identification and the Government's response

PAC Recommendation 1

All casualties suffered by our Armed Forces are a serious matter. Casualties among our own or allied troops from “friendly fire” are a profoundly unfortunate risk of war as are civilian casualties. In 1992, our predecessors concluded that the Department should redouble its efforts to secure an agreed approach to procuring what was then known as an Identification Friend or Foe system. A decade later, the Department has only just approved a policy paper on Combat Identification, and many of the solutions required to implement that policy are years away from fruition. **It is unsatisfactory that the Department has made such slow progress in developing Combat Identification solutions to the risks of friendly fire, and it needs to increase the tempo of its efforts.**

Government response

The Department addressed significant changes in the nature of the Combat Identification problem and the potential solutions during the 1990s. Combat Identification is not an end in itself but a very important contributor to combat effectiveness within the concept of manoeuvre warfare. The Department aims to achieve a military objective with the minimum casualties to all parties by using speed and agility, by having a good picture of what is going on (situational awareness) and by precise targeting with long range precision weapons. The emergence of these current concepts of warfighting took place in the 1990s under the influence of two major trends. The first was a move away from the fixed NATO military concepts, which underpinned the Cold War confrontation of NATO and Warsaw Pact forces in north-west Europe, towards much more flexible joint and coalition military operations with expeditionary forces in different and more fluid environments. Key signposts were the creation of the Permanent Joint Headquarters (PJHQ) in 1996 and the Strategic Defence Review (SDR) in 1998 which established the framework for manoeuvre warfare. The second trend was the rapid development of information technology led by developments in the civil sector that provided the means to move very large

amounts of data in near real time and offered great improvements in situational awareness. Together these trends had the effect of changing the perception of how Combat Identification objectives should be achieved. A similar process was underway in NATO. Attention turned to systems which provide greater situational awareness. In the long term they will play a much larger role compared to more narrowly defined Identification Friend or Foe (IFF) and target identification devices. In the short term the emphasis has been on tactics, techniques and procedures as these are very cost effective and easier and quicker to implement than complex technical solutions.

The Department has avoided nugatory expenditure on obsolescent solutions by working closely with allies on emerging expeditionary requirements in the context of the new strategic environment. As reported to the Committee, significant investment (£396 million) is being made in the Successor Identification Friend or Foe (SIFF) programme that will equip 38 different platform types (aircraft, ships and ground based air defence) with a secure capability to identify friendly air platforms positively. The system is interoperable with our allies and the first platforms will be fitted with the equipment this year. The Department is also investing in a range of assets that contribute to improved situational awareness, for example BOWMAN, ASTOR and United Kingdom Co-operative Engagement Capability (CEC) as well as data systems to disseminate operational and intelligence information. The Department continues to play a leading role in achieving progress among allies and notes the need to match all the interests involved in areas such as Battlefield Target Identification (BTID). An indication of the extensive range of activities and programmes that the Department has pursued is given at Appendix 1 of the Minutes of Evidence. The totality of work was crystallised in the Combat Identification policy document produced in 2001, which brought improved coherence to the ongoing delivery of Combat Identification capability that the Department requires in the operations in which it is likely to be engaged. Work will be taken forward vigorously and the Department will continue to review and update Combat Identification capability as the threat evolves.

PAC Recommendation 2

In addition to the risks to our Armed Forces, the absence of an effective Combat Identification capability can also increase the risk of civilian casualties in conflicts. If not addressed, public concern about civilian casualties may adversely affect the willingness of the public to support future operational deployments. **The Department needs to provide a clearer account than it has done so far of the steps it is taking to reduce the risk of civilian casualties and when these measures will be in place.**

Government response

The Department aims to minimise all casualties on the battlefield by improving combat effectiveness by, among other things, using effective Combat Identification. The issue of identifying non combatants can be addressed, for example, with tactics, techniques and procedures by assessing the behaviour of a potential target to see if it is consistent with military activity, and through situational awareness. The steps being taken will increase operational efficiency and enable our forces to make better judgements about the presence and location of non-combatants on the battlefield, thus reducing the risk of civilian casualties. Improved situational awareness in complex land environments provided by systems such as BOWMAN from 2004 will be particularly relevant.

PAC Recommendation 3

Most future military operations that our armed forces undertake are likely to be in coalition with allies, which obviously complicates combat identification and increases the risks of friendly fire. **The Department needs to develop the existing methods of cooperation to address these additional risks.**

Government response

The Department has considerable experience of military operations with allies and planning for such operations routinely takes into account the need to establish robust procedures at an early stage, as was the case in recent operations with United States of America forces in Afghanistan. Such arrangements will continue to be developed for any future joint and combined operations.

PAC Recommendation 4

The Department possesses a dearth of data on the level of fratricide from past operations and exercises, and undertakes limited analysis of the data that is available.

The Department should produce a database on the level of fratricide, and ensure that the information gathered is robustly analysed and disseminated appropriately within the United Kingdom and to coalition partners.

Government response

There have been no reported instances of fratricide involving United Kingdom Forces since the Gulf War in 1991. The Department has put in place mechanisms to gather information on Combat Identification effectiveness during training exercises and has commissioned work to investigate if and how incidents of misidentification are recorded by the United Kingdom Armed Forces and how information from such incidents is used to initiate changes to Combat Identification. Recommendations will be made by April 2003 on how the United Kingdom Armed Forces could most effectively collect and analyse information about incidents of misidentification in order to bring about overall improvements to Combat Identification. Furthermore, in April 2002 the United Kingdom participated in the Joint Combat Identification Evaluation Team 2002 (JCIET 02) with the United States of America and initial analysis has already revealed a number of lessons which will be followed up. For example, it has highlighted engagement opportunities that were missed for reasons of lack of identification, resulting in reduced combat effectiveness. The next exercise is planned to be held in 2004.

APPENDIX 2

Summary of Board of Inquiry Reports into Fratricide Incidents during Operation TELIC

The Shooting down of an RAF Tornado by US Patriot Missile on 22 March 2003

1 RAF Tornado shot down by a US Army Patriot Surface to Air Missile on 22 March 2003 after being wrongly identified as an Iraqi anti-radiation missile when returning to its air base in Kuwait. Two crewmen were killed instantly. The investigation identified that aircraft had been fitted with a working identification friend or foe device, and the procedures, to ensure the associated system was working and was switched on, had been followed. The aircraft had appeared as an anti radiation missile on the radar of the US crew operating the Patriot equipment, which was also fitted with IFF equipment. The US crew had interrogated the aircraft for an identification friend or foe response, but no response was received. The Patriot crew had complied with the appropriate Rules of Engagement.

2 The RAF Board of Inquiry was carried out in parallel with a US investigation. The Board of Inquiry concluded that there were a number of contributory factors to the accident. These included technical factors, for example the Board concluded that the Tornado's identification friend or foe system must have been faulty, although it was checked before take-off, because there was no evidence it had responded to any interrogations throughout the mission. The most likely cause was a power supply failure. Also, the missile classification criteria programmed into the Patriot computer were too broad; being based on all anti-radiation missiles available worldwide, rather than the known threat from Iraq. In addition, the Patriot identification friend or foe device was not loaded with Mode 1 codes, an unencrypted code which was used by all coalition aircraft in Iraq. The lack of Mode 1 codes had increased the probability of the accident.

3 There were also procedural causes – for example, the doctrine and training of the Patriot crew required them to react quickly, and engage early. If the crew had delayed engagement the aircraft would probably have been reclassified when it changed its flight path. Procedures for routing and control of airspace had been followed, but had not taken into account the position of the Patriot equipment. The Board concluded that airspace routing and control, and a breakdown in planning and communication were contributory factors. Also relevant was the fact that the Patriot communications suite, which would have provided better situational awareness of the airspace around them, was still in transit from the US. The Board of Inquiry report concluded that the contributory factors were complex, many and various, and has made a series of recommendations which are currently being implemented.

Death of Marine as a result of fratricide from 42 Commando Brigade, on 30 March 2003

4 On 30 March 2003, a Landing Craft with a crew of five Marines patrolling in the Al Faw peninsula, south of Basra, came under fire from Milan anti-tank missiles and light arms fire from a unit of 42 Commando Brigade, who were also carrying out operations in the area. One of the Marines died later from his injuries, and the other four Marines suffered injuries.

5 The initial investigation by the Special Investigation Branch of the Royal Military Police identified that the Marine had died as a result of enemy action, and their final report, concluded that it was not possible to identify to a degree of certainty the weapon system that had caused his death. Following a BBC documentary in July 2003 which presented evidence casting doubt on the conclusion of the Military Police investigation, a Board of Inquiry investigation was convened. Their report, produced in December 2003, concluded that the Marine had died as a result of friendly fire.

6 The causal factors identified by the report were mainly related to procedures and communication. Small craft such as the Landing Craft involved in this incident, were not fitted with Target Identification devices, and did not have access to sophisticated Situational Awareness information. The report concluded that the means of identifying craft of this type was inadequate in the circumstances – partly aggravated by a tactical decision onboard the landing craft to lower its mast (with ensign) – and battlespace management in the area had become degraded at the time of the incident. In addition, it identified deficiencies: in the chain of command operating in the specific area; in the application of operational procedures; and in the methods of communication used between units within the same area – some or all of which contributed to varying degrees.

Death of Lance Corporal of 16 Air Assault Brigade as a result of fratricide from US Air Force A10 on 28 March 2003 in Southern Iraq

7 During Operation TELIC, Close Air Support was provided to the United Kingdom's 16 Air Assault Brigade by a US Reserve unit, 3rd Anglico. On 28 March 2003 a recon patrol of the Brigade was advancing North East from the Ramaylah Oilfields. A flight of two US A10 aircraft from the 3rd Anglico had been tasked with missions against Iraqi forces in the area. One of the A10s attacked the two lead combat vehicles in the United Kingdom patrol, believing them to be Iraqi rockets. The attack resulted in the death of a Lance Corporal and serious injuries to four further crew members of the Combat Vehicles, and damage to a Spartan light armoured vehicle nearby. Both Combat Vehicles were destroyed. The A10 had attempted to confirm that the vehicles were not friendly before attacking. Information was provided from the US Liaison Team that there were no friendly forces in the area.

8 Separate inquiries were carried out into the incident in the United States of America and the United Kingdom. The United States of America inquiry reported in October 2003. The United Kingdom inquiry was convened in February 2004. As the incident was similar to the incidents of fratricide in the first Iraq conflict, Operation Granby, involving US A10 aircraft, in which 9 United Kingdom personnel died, the inquiry was tasked with reviewing the lessons learned following these incidents.

9 The A10 pilots had initially thought the vehicles were friendly, believing they had sighted orange panels on the vehicles (thermal identification panels which would indicate friendly vehicles), and made several attempts to confirm their identity. But having received information from their US Liaison Team that there were no friendly forces in the area, they then decided they were enemy rocket vehicles, and engaged the two lead vehicles. Soldiers in the convoy, realising they were the target of United States of America aircraft, took action to prevent a further attack, including releasing red smoke to indicate the suspected friendly fire. The United States of America Forward Air Controller then instructed the A10 pilot to call off the attack.

10 The Board concluded that the cause of the incident was that the A10 had engaged the United Kingdom patrol believing it to be hostile, without the required authorisation from the United States of America Liaison team. Contributory factors to the incident included:

- the employment of the least restrictive Rules of Engagement for Close Air Support (Type 3) without providing sufficient control or situational awareness (in particular data on the position of friendly forces);
- human factors given the pilot's expectations about the absence of friendly forces in the area (based on information and briefings provided on the nature of the enemy forces), and task saturation of the pilots had contributed to the misidentification of orange panels as orange rockets;

- although the patrol vehicles had been fitted with thermal identification panels (the orange panels), adaptation of those panels (with day glow side panels) had contributed to the vehicle's misidentification;
- the pilots had received minimal recognition training on allied fighting vehicles, making it impossible for them to positively identify the combat vehicles; and had to rely on binoculars to identify the vehicles from a height of 5,000 to 6,000 feet;
- poor communication during the sortie had led to confusion and lack of situational awareness (for example, the pilots had not passed any details of their intended target (the UK patrol) or sighting of the orange panels to the US Liaison Team).

Death of two soldiers in British Challenger 2 tank incident outside Basra

11 On 25 March 2003 in the early hours of the morning, a British Challenger 2 Tank protecting a bridge on the Shatt al Basra canal came under fire from a British Challenger 2 Tank from another regiment and some distance away. Two soldiers were killed and two more were seriously injured. The incident occurred during the warfighting phase of Operation TELIC with all the pressures and difficulties associated with an operational environment.

12 As well as the Board of Inquiry, the Royal Military Police's Special Investigation Branch carried out an investigation. The case was referred to the independent Army Prosecution Authority, which concluded that no-one should face charges in connection with the incident.

13 The Board of Inquiry concluded that the factors which may have contributed to the incident included:

- Boundaries between the units and arcs of fire should have been better briefed and disseminated.
- The location of the friendly tanks and the dam should have been more generally known.
- The brief for the handover of a tactical position should have been more structured with the troop and platoon acting in a more co-ordinated and unified manner to ensure adequate liaison and communication.
- The crew of the tank which opened fire should have "displayed more inquisitiveness" about the details of the task over the bridge.
- The crew of the tank which opened fire was not orientated accurately and so placed the potential target on the wrong side of a nearby canal.

14 The Board of Inquiry recommended improvements to training, target recognition and fire control. They included training for crew commanders to exploit Bowman situational awareness capability, upgrades to the Unit Recognition Trainer and the reinforcement of fire control and discipline in training.

APPENDIX 3

Areas for improvement in Combat Identification incorporated into the Department's action plan after Operation TELIC

Area	Action
Doctrine	A Joint Warfare Publication on Combat Identification – now produced and published and due for revision in the second quarter of 2006.
Training/Education	<p>A Combat Identification career training package has been put in place at training establishments in each of the Services.</p> <p>Opportunities are taken for routine training with allies using scenarios that reflect the modern battlespace, and focus on Combat Identification issues. Latest example is Exercise Urgent Quest, the Coalition Combat Identification Advanced Concept Technology Demonstrator in September 2005.</p> <p>Opportunities are taken in routine training to develop and test joint tactics techniques and procedures for Combat Identification, although more work is needed to allow training with Combat Identification equipment such as Combat Identification Panels and Thermal Identification Panels.</p> <p>Provision of IT-based Joint Recognition Training System. A programme is in place with a planned in-service date of 2009. In the meantime, the Navy has acquired a number of systems to conduct trials of a modern IT-based recognition training system.</p> <p>Robust capture of Combat Identification data from training and other events and its analysis and feedback into the development of tactics, techniques and procedures. Opportunity presented by Exercise Rapid Alliance in June 2004 was taken and capture of data from training is now a routine activity. Arrangements for extracting and analysing lessons from the Boards of Inquiry is improved.</p>
Equipment	<p>Due priority should be given to Combat Identification improvements in the Department's resource planning process. Combat Identification was a recognised priority in the 2005 Defence planning round.</p> <p>Participate in the United States of America-led Coalition Combat Identification Advanced Concept Technology Demonstrator and closely track US Combat Identification activity. The United Kingdom participated fully in the Exercise in September 2005. A two way communication flow is maintained through the British Defence staff in Washington to provide regular up to date information to support co-ordination with the United States of America.</p>
Personnel	Research into role of human factors in Combat Identification performance and consideration of the differences between the United Kingdom and United States of America approaches to Combat Identification. A significant amount of human factors research has been commissioned through QinetiQ, who have been involved in gathering data from exercises such as Urgent Quest. This has informed training packages and initiatives such as the Combat Identification aides-memoires. It has also helped together with information from the British Defence staff in Washington to address issues arising from differences between the United Kingdom and United States of America approaches to Combat Identification.
Information	Share information with allies to enhance Combat Identification and ensure Tactics, Techniques and Procedures are well practised. The United Kingdom is active in NATO, maintains close communication with the USA and participates in multinational exercises.

Source: The Ministry of Defence

APPENDIX 4

Examples of Major Equipment Programmes providing Situational Awareness and Target Identification Capability

Programme	Description	Responsible Directorate of Equipment Capability	Stage
Target Identification Programmes			
Successor Identification Friend or Foe (SIFF) ¹	SIFF has replaced or is replacing many existing Identification Friend or Foe systems currently in use on aircraft and ships. It will provide a modern, NATO-compatible, secure Identification Friend or Foe system on aircraft, ships, and Rapier missiles, for swift and accurate identification of friendly forces.	Theatre Airspace	In Service
Battlefield Target Identification System (BTIS) ¹	Programme to identify and select the most cost and operationally effective technology for a BTIS, primarily for a range of possible applications. Initial Gate submission is now expected in Summer 2006.	Ground Manoeuvre	Concept
Situational Awareness Programmes			
UK Co-operative Engagement Capability (CEC) ¹	Early warning and data distribution system. Distributes and fuses data from all CEC equipped ships, aircraft and land sites, allowing improved detection, tracking and identification of air targets.	Intelligence Surveillance Target Acquisition and Reconnaissance	Assessment
Airborne Stand Off Radar (ASTOR)	Theatre surveillance and target acquisition system, comprising 5 air platforms and 8 ground stations. It will pass high resolution images in near real-time to ground stations, for onward transmission to battlefield commanders.	Intelligence Surveillance Target Acquisition and Reconnaissance	Demonstration & Manufacture
Link 16 ¹	A tactical data link progressively fitted to aircraft and ships since 1991. Link 16 provides positive identification of all platforms equipped with the datalink to all recipients of the Link 16 picture, so enhancing situational awareness. Includes the Navy's Joint Tactical Information Distribution System programme involving full integration of the data link into ships' combat systems, and the Tactical Information Exchange Capability programme for fitting Link 16 and data modem to the GR4 Tornado and the Harrier GR9.	Command Control and Information Infrastructure	Capability in Service

Highest Approved expenditure at Main Gate £ million (current forecast cost £ million) ² Original approved funding if pre Main Gate	Latest acceptable In Service Date at Main Gate (achieved date)	Target Date for Full Operational Capability	Comments
£548 million (£464 million)	Separate In Service Dates for 6 different platform systems between April 2004 and September 2005. Each In Service Date is now achieved (November 2003 to February 2005)	Contract completion date is in 2009	Programme is within time and cost approvals.
N/A	N/A	N/A	UK ratified a NATO Battlefield Target Identification Device standardisation agreement in June 2000. The UK then began a programme to produce a compliant technical solution, successfully demonstrating a prototype in September 2001. Target for Initial Gate approval is Summer 2006.
£25 million	N/A		The project has been deferred and is being rescope following balance of investment decisions in the 2005 Defence planning round.
£914 million (£954 million)	September 2005	December 2008	ASTOR was expected to enter service in 2005. In Service Date is now under review because of technical issues with the radar. Current forecast is November 2006.
£362 million for the original project	In Service Date for Joint Tactical Information Distribution System is between 2004 and 2008	Range between 2004 and 2008 for individual programmes. Full Operating Capability for fitting Link 16 on Tornado and Harrier is yet to be decided	New platforms, for example, Typhoon, A400M, and Future Strategic Tanker Aircraft will be delivered with Link 16 capability.

Programme	Description	Responsible Directorate of Equipment Capability	Stage
Ground Based Air Defence (GBAD) Phase 1/ Land Environment Air Picture Provision (LEAPP)	GBAD Phase 1 involved integration of current GBAD weapon systems (e.g. Rapier and High Velocity missile) with an overarching Air Defence C4I system, improving their Situational Awareness, and allowing full range and capability of existing weapon systems to be exploited. GBAD Phase 1 was rescoped when funding was reduced, and the LEAPP programme now focuses on distribution of the Recognised Air Picture to Land forces operating in the Land environment, so improving situational awareness and reducing fratricides.	Theatre Airspace	Assessment
Bowman ¹	Providing a secure tactical voice and data communication system for all three services in support of land, littoral and air manoeuvre operations. This will improve Situational Awareness, so increasing combat effectiveness and reducing fratricide.	Command Control and Information Infrastructure	In Service
Combat, DBL Infrastructure and Platform BISA (CIP)	CIP comprises three closely interrelated projects procured as a single entity through the Bowman prime contractor. The programme will integrate CIP with other systems and sensors already fitted to fighting vehicles, and provide communications interoperability with UK and international systems.	Command Control and Information Infrastructure	Demonstration & Manufacture
Future Integrated Soldier Technology (FIST)	FIST will deliver enhanced situational awareness to the soldier engaged in dismounted close combat through an integrated suite of equipment. This should reduce instances of fratricide. The FIST team is monitoring the Battlefield Target Identification System study and output from Advanced Concept Technology Demonstration related activities, in particular the demonstration of dismounted soldier technologies.	Ground Manoeuvre	Assessment
Cancelled Programmes			
Airborne System for Target Recognition, Identification and Designation (ASTRID)	Project to develop an air-to-ground Target Identification system with three European partners, to deliver identification at much greater ranges than current equipment.	Theatre airspace	Cancelled

Source: National Audit Office

NOTES

1 These programmes were examined in the C&AG's Report, Combat Identification (HC 661 Session 2001-2002).

2 These figures are as at 31 March 2005.

Highest Approved expenditure at Main Gate £ million (current forecast cost £ million) ² Original approved funding if pre Main Gate	Latest acceptable In Service Date at Main Gate (achieved date)	Target Date for Full Operational Capability	Comments
£144 million	N/A	N/A	Target In Service Date was January 2007. Internal planning assumption for entry into service is 2010.
£2,041 million (£2,007 million)	December 2004 (March 2004)	2007	The In Service Date for Bowman was declared in March 2004, subject to a number of provisos.
£379 million (£338 million)	December 2004		The In Service Date was not achieved mainly because the capability demonstrated was not sufficiently stable and reliable. A revised in service date is under consideration.
£26 million	N/A		Main Gate submission will be made when the project achieves the necessary maturity.
N/A	N/A	-	£91 million allocated in 2001 for concept to integration into service of up to 40 systems from 2010. Funding for the programme was withdrawn in 2004, although the requirement remains. Funding has now been allocated under the Battlefield Target Identification System programme to provide a capability.

APPENDIX 5

Progress in Issuing and Ratifying NATO Standardisation Agreements for Combat Identification Systems

Agreement Number	Description	Environment	Status in March 2002	Current position
4193 Parts V and VI	NATO Identification Friend or Foe – Mode 5/Mark 12A capability	Air to Air/ Surface to Air	Being developed by NATO Working Group	Agreement to be released for ratification by member countries later in 2005
4162	Identification Data Combining Process	General	Completing implementation	Ratified
–	Agreement for Air to Ground Co-operative Identification system	Air to ground	–	NATO Staff Requirement issued December 2003. Target date for issuing Agreement is late 2007
4579	Battlefield Target Identification Device (BTID)	Ground to Ground	Agreement was issued in August 2001 and has been ratified by member countries including the UK, USA, France and Germany	UK procurement decision is dependent on the outcome of a research package that will report by April 2006, and the Coalition Combat Identification Advanced Concept Technology Demonstration, and US procurement decisions
4630	Dismounted Soldier Identification	Ground to Ground	At draft NATO Staff Requirement stage	NATO Staff Requirement now approved, and Agreement issued for national ratification, but not accepted by any NATO members
5511	Link 11 is a secure data link dedicated to command and control units	All	Edition 4 was promulgated in January 2003 having been ratified by the UK in November 1996	Edition 5 was issued in January 2003 and ratified by the UK in June 2005
5516	Link 16 is a secure data link offering greater security and data throughput than Link 11	All	Edition 2 was promulgated in January 2003 having been ratified by the UK	Edition 3 was issued in January 2003 and ratified by the UK in June 2005
5522	Link 22 is a secure data link that is replacing Link 11	All		Agreement was issued for national ratification in May 2002. It was ratified by the UK in June 2005
2129	Identification of Land Forces on the Battlefield and in an area of operation	Ground to Ground and Air to Ground		Edition 7 was promulgated in April 2002

Source: National Audit Office

GLOSSARY

Combat Identification	The process of combining situational awareness, target identification, specific tactics, techniques and procedures to increase operational effectiveness of weapons systems and reduce the incidence of casualties caused by friendly fire.
Combined/coalition operations	Operations where a number of countries' services work together.
Fratricide	The accidental death or injury which occurs when friendly forces engage their own forces believing either them, or their location, to be an enemy target.
Interoperability	The ability of Alliance forces and, when appropriate, forces of Partner and other nations to train, exercise and operate effectively together in the execution of assigned missions and tasks.
Joint	Adjective used to describe activities, operations and organisations in which elements of at least two national services participate.
Rules of Engagement	Directives issued by a competent military authority which specify the circumstances and limitations under which forces will initiate and/or continue combat engagement with other forces encountered.
Situational Awareness	The aim of Situational Awareness is to increase combat effectiveness by helping military personnel gain a better understanding of the environment – the battlespace – in which they are operating. This is achieved by providing timely and accurate information. It comprises intelligence and identification information from a range of sources
Standardisation Agreement (STANAG)	The record of an agreement among some or all NATO member nations to adopt like or similar equipment or procedures
Tactics, techniques and procedures	The aim of tactics, techniques and procedures is to guide behaviour in operations and when followed by military personnel improve target identification and situational awareness, when applied with the range of technical solutions available. They are developed by either individual services – Army, Royal Navy and Royal Air Force – or jointly. They evolve from military doctrine or lessons learned in operations.
Target Identification	The aim of Target Identification is to identify, to a high degree of confidence, all contacts (people and vehicles) in the Joint Operations Area to assess whether they are friend or unknown.

Source: UK Glossary of Joint and Multinational Terms and Definitions