What value analysis? The Historical Record of Fratricide

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DSTL/PUB19632

Structure

- Example UK fratricide incidents
  - Open-source reports from Boards of Inquiry
  - Problems of analysing such data
- Root cause analysis of fratricide incidents
  - Method used and findings
- International collaborative research on the historical record
  - Findings and recommendations
- Conclusions

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Case Study #1: RAF Tornado – 22 March 2003

Details taken from MOD Board of Inquiry reports posted at:
www.mod.uk (search on “Board of Inquiry”)

Case Study #1: RAF Tornado – 22 March 2003

- Two U.K. Tornado GR4s were participating in a combat strike mission over Iraq as part of Operation Iraqi Freedom.
- Whilst returning to base after a successful sortie, a fratricide incident occurred when the aircraft was targeted by the US Patriot missile.
- The Patriot believed the Tornado to be an Anti-Radiation Missile and, perceiving a threat, acted in self-defence by launching a Patriot II missile to intercept it.
- During this engagement, the RAF Tornado was shot down and its two crew members were killed.

Case Study #1 - Causes

- Tornado's IFF system:
  - Was faulty - no Mode 4 response transmitted.
- Patriot system anti-radiation missile classification:
  - Classification criteria too generic; Rules of Engagement not sufficiently robust.
- Patriot firing doctrine and training:
  - Crew fully trained but training concentrated on recognising generic threats rather than specific or false alarms.
- Autonomous Patriot battery operation:
  - Missing comms equipment: crew did not have access to widest possible SA 'picture' (which would have helped).
- Patriot IFF procedures:
  - Mode 1 codes were not loaded (possibly due to comms problems).
- Aircraft routing and airspace control measures:
  - Both contributed, together with breakdown in planning and communication.

Commonality of causes

- **Equipment** operation (Patriot classification scheme, Tornado IFF).
- **Procedures** (Patriot firing doctrine and procedures, CR-2 incident basic military skills, 3 Cdo Bde and 539 ASRM in the Al Faw Peninsula).
- **Communications** problems (Patriot communications, unreliable and convoluted comms at XP ANNA in the Al Faw Peninsula).
- **Battlespace management** (Tornado routing and airspace control, 3 Cdo Bde in the Al Faw Peninsula).
- **Planning** (the Challenger-2 operations around the dam).
- **Passing information**, leading to poor situational awareness (about boundaries and location of friendly forces in the CR-2 incident).
- **Command and control** (coordination in the CR-2 incident, chain of command at XP ANNA in the Al Faw Peninsula).

Boards of Inquiry analyses

- Purpose of a UK Board of Inquiry:
  - *"A BOI is conducted by the MOD for the purpose of establishing the circumstances surrounding serious accidents and incidents".*
- Each BoI determines its own approach to data collection and analysis:
  - There is no agreed schema within UK for categorisation of root causes for BOI investigations.
- It is therefore difficult to:
  - aggregate analyses across incidents
  - compare root causes across operations
  - determine trends in root causes

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Investigation of historical records to identify causal factors behind fratricide incidents

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31 August 2006

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Root cause analysis

- Aim: To investigate historical causes of fratricide and identify the key causes and contributing factors in order to formulate recommendations for reducing their likelihood in the future and for improved representation of such causal factors in representational models.
- Objectives:
  - Conduct detailed case studies based on detailed Board of Inquiry reports.
  - Identify key environmental, organisational, social and cognitive stressors/factors cited as contributing factors; identify recurring patterns and/or themes.
  - Formulate recommendations for reducing negative impact.

Event timeline - example

Date, Time, 'Players', Location

Additional supporting information

Reference number (for correlation with table of causes)

REF.	DATE	TIME	WHO	WHERE	ACTION	OTHER
1	17/04/02	16:01Z	"A" Company, 3rd Battalion, Princess Patricia's Canadian Light Infantry BG (3 PPCLI BG)	Vicinity of Kandahar, Afghanistan	Commenced a live-fire exercise at the Tamak Farm Multi-Purpose Range Complex.	"A" Company were one of three companies within the 3rd Battalion of the PPCLI, attached to the American-led Task Force Rakkasan. The Tamak Farm Multi-Purpose Range Complex was formerly one of the main Al-Queda training installations. It was established to provide a venue for tactical training scenarios, including live-fire manoeuvre using small arms, heavy machine guns, anti-armour weapons and mortars. As part of the planned night exercise (to build on their existing night-fighting skills sets), "A" Company personnel were conducting a variety of firing drills, encompassing a range of weapons from personal side arms up to and including shoulder-fired anti-tank munitions.
2		c. 21:00Z	2 American F-16 fighter aircraft (*Coffee 51 & 52*)	Northeast Afghanistan	The F-16 sortie departed its area of operations in north-east Afghanistan, heading south-west towards Kandahar, en route to a rendezvous with tanker aircraft.	
3		c. 21:21Z	2 American F-16 fighter aircraft	Vicinity of Kandahar, Afghanistan	Returning to their home base in the Arabian Gulf area after a long patrol over Afghanistan. As they transited through the	

Description of action

Fratricide Causal Analysis Schema

Fratricide Causal Analysis Schema

- Command and Control
- Procedures
- Equipment/Technology
- Situational Awareness
- Misidentification
- Physical/Psychological
- Pre-deployment Preparation
- Teamwork
- Environmental
- Communications/ Information
- Platform Configuration
- Cognitive Factors

Fratricide Causal Analysis Schema

- **Command and Control**
- Procedures
- Equipment/Technology
- Situational Awarene
- Misidentification
- Physical/Psychologi
- Pre-deployment Preparation
- Teamwork

- Commander's intent
- Orders
- Briefing
- Planning
- Co-ordination
- Disruption of C2

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Presentation of causal factors

High-level causal factor category

Brief description of cause/contributing factor

Event timeline reference

Cause/contributing factor sub-category label from Fratricide Causal Analysis Schema

Contributing factor	Description	Timeline reference
Command and Control (C2)		
Orders	No detailed Warning Orders were provided to the six-man patrol and, therefore, they embarked on their mission with incomplete information and inadequate direction [1].	
Briefing	Force Recce Snipers were not briefed on the specific actions, or intentions, of any battalion patrols operating outside of the battalion compound on the evening of the incident and therefore did not possess a complete awareness of the situation. Their instructions were to provide observation of the area surrounding the Battalion Command Post and engage targets that displayed hostile act or hostile intent in accordance with the standing Rules of Engagement (ROEs) [1].	
	Due to the Sergeant's poor knowledge and confusion of the layout and location of the area that the patrol was tasked to control, he was not able to give his team a full and concise brief. It was reported that the Sergeant drew sketches of the area, but the six-man patrol found them confusing [1].	5
Planning	The Sergeant of the six-man security patrol did not have a clear plan for how he was going to the position the Marines once they had arrived at the objective (the green domed building). Their mission was to keep a lookout for Ba'ath party members (Iraqi militants who had been terrorizing the locals living in the area) that were firing on their patrols and ambush/kill these men if spotted carrying weapons [1].	
Coordination	There was no detailed coordination of the snipers in the Ministry complex and/or the occupation of the domed building, by the six-man patrol. In such a built up area, effective coordination would be essential [1].	
Procedures		
Standard Operating Procedures (SOPs)	The victim had removed his protective flak jacket and helmet prior to the incident (it is reported that he had been issued with an extra small flak jacket and had been using extra-large protective plates, front and rear which, if worn in a prone position, would have been uncomfortable and would have made the effective employment of a weapon difficult [1]). The 3rd Battalion, 4th Marines, Standard Operating Procedure (SOP) required all Marines to wear a flak jacket and Kevlar helmet at all times, even when behind friendly lines (these rules also applied to the attached Force Reconnaissance Marines). The only time Marines were authorised to remove these items was when they were inside a hardened headquarters (HQ) building. These items of clothing served to distinguish Marines from	

Fratricide incident sample

- 10 fratricide incidents selected for detailed study
  - Operation GRANBY (Operation Desert Storm) - 1991
  - Operation PROVIDE COMFORT - 1994
  - Operation TELIC (Operation Iraqi Freedom) - 2002/2003
- Chosen on the basis of:
  - detail of reports available
  - reliability of information sources

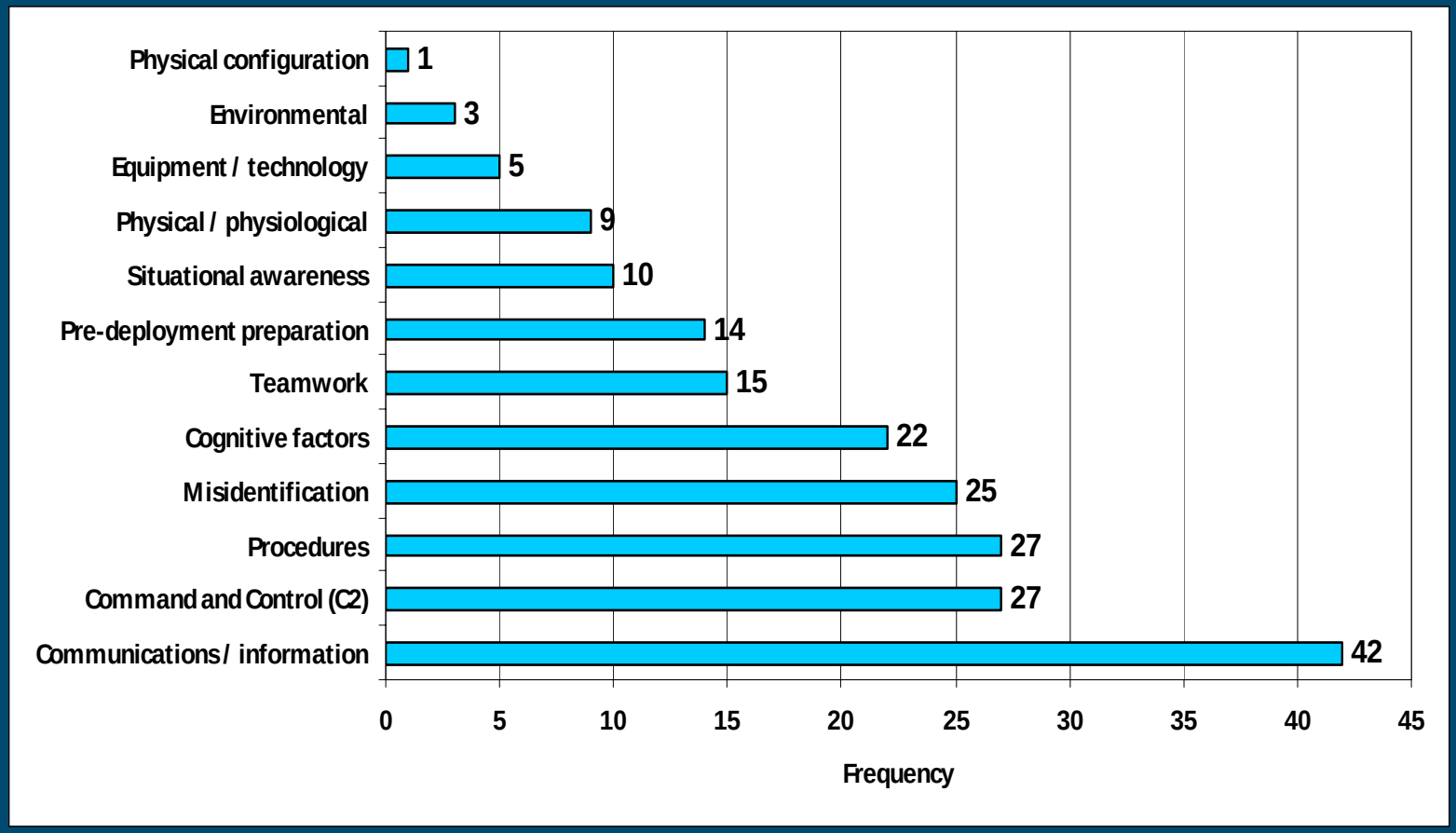
Identifying root causes

- Importance of the causal chain
  - Fratricide incidents rarely have a single cause.
- Incidents are the culmination of a series of combat activities and errors can occur at any of these stages.
- There is sometimes a tendency to take too ‘local and narrow’ a view:
  - Incidents can only be truly understood when all possible impacting factors are taken into account and put into their full systemic context.

Constraints and limitations of analysis

- Consistency in allocating causes to categories in the categorisation schema.
- Frequency analysis is based on a small number of incidents.
  - Take care in making assumptions about overall significance of different factors.
- ‘Situational Awareness’ is a high-level category:
  - But SA factors often assigned more appropriately to lower-level categories.
  - So SA as a category is under-represented in the frequency analysis.

Prevalence of causal categories



The analysis findings indicate clearly that the common causes of fratricide are often non-technological in nature.

Conclusions from historical analysis

- Value from historical analysis requires:
  - Detailed records.
  - A common categorisation schema.
- Causal analysis:
  - Fratricide incidents rarely have a single cause.
  - The causes cannot be examined in isolation.
  - Common causes of fratricide are often non-technological.
  - Most prevalent categories of causes (as identified in this analysis):
    - Communications/Information, Command & Control, Procedures, Misidentification, Cognitive Factors.
  - Poor situational awareness is a major contributory factor.

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International Collaborative Research on “Fratricide Mitigation”

TTCP Joint Systems & Analysis

Action Group 13

Canada (lead), US, UK, Australia

Aim of Action Group 13

"To establish a broad appreciation across the TTCP community on the evidence derived from the historical record of the past decade as to the trends in fratricide or 'friendly fire' incidents, to position this evidence in the context of military casualties more generally, to extrapolate these trends into the future as network-enabled operations gain momentum, and to postulate approaches that could/should be taken to mitigate such fratricide without negatively impacting on mission success or overall casualty rates, including through the development and application of technology."

Historical record workshop (Oct 05) - objectives

- To understand:
  - The different nations' approaches to the collection of data on fratricide, near misses and non-battle casualties;
  - The nature of the different national records;
  - The analyses conducted on those records;
  - The validity and utility of those records;
  - The potential for collaborative sharing of records, analyses and findings.

National definitions of fratricide

- Different nations have different definitions of fratricide (and sometimes several definitions within one nation!) which vary according to:
- **What was the intent?** Did the shooter intend to kill/destroy the target (or was it an accident)?
- **Who was the victim?** Friendly or neutral (i.e. does the definition include what some would call 'collateral damage')?
- **What was the result?** Death, wounding, or damage to major equipment capability?
- This confuses collaborative work (e.g. comparison of fratricide rates across nations).

The contribution of the historical record

- What are the underlying causes of fratricide?
- What are likely to be the most cost-effective remedial actions?
- The historical record can therefore contribute …
- … but we need structured data collection:
  - What are the requirements for a good data collection policy?
  - What is best practice in data collection?

Requirements for a good data collection policy

1. A champion is needed for fratricide data collection.
2. Engage training commanders early in exercise planning.
3. Those collecting data need to know: what, why and how.
4. Centralised data collection facilitates sharing and collation of national records.
5. Type 4 friendly fire data (where no injury or death occurred) also has utility.
6. A joint service approach to investigation of friendly fire is required.
7. A coalition approach to investigations would assist data sharing.
8. A minimum set of baseline data should be collected in all cases.
9. Strongest efforts should be made to collect data from operations.

Good practice for data collection

1. Data collected should include the context of the incident.
2. Training/exercise data is important as a complement to data from operations.
3. Data collection should focus on both shooter and target.
4. Data should be collected as soon as possible after the event.
5. Avoid focussing on technical/instrumented data; face to face interviews are a rich source of data.
6. Where possible there should be a ‘no blame’ data collection policy.
7. Interview those involved separately – and in confidence.
8. Collect a core set of data elements – in operations or training.
9. Collect data from historical and current operations, and training.
10. Legal and ethical issues must be taken into account.
11. Boards of Inquiry should call on those with expertise in friendly fire.

Why share data and analyses?

- Access to broader range of data sources
  - Including different operating environments.
- Larger data sets give greater statistical robustness.
- Understanding coalition perspectives
  - Including other nations' statistics
- Economy of effort.
- Comparing sources and de-conflicting evidence.
- As focus for bilateral work on specific incidents.

Barriers to sharing

- Releasability, legal and ethical issues.
- Data archiving formats.
- Terminology and definitions.
- Establishing relationships between the analysts.
- Establishing communications between the analysts.
- Knowing that the work exists!

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Conclusions - Part 1

- Whilst the methods used by Boards of Inquiry are well suited to their immediate purposes, it is difficult to:
  - aggregate analyses across incidents
  - compare root causes across operations
  - determine trends in root causes.
- A common approach to Boards of Inquiry would help.
- Fratricide incidents are caused by a chain of failures
  - need “identification in depth” which provides a series of measures to protect against both technology failure and human error.
- If you learn to rely on technology, and then it fails, you can have problems.

Conclusions - Part 2

- Understanding root causes of friendly fire incidents is key to improving future operational effectiveness and reducing fratricide; this requires:
  - detailed records – preferably using a common approach to data collection
  - structured analysis which enables determination of chains of causes.
- Most prevalent causes (from our analyses):
  - Communications/Information, Command & Control, Procedures, Misidentification, Cognitive Factors
  - Poor Situational Awareness is a major contributory factor.

Conclusions - Part 3

- Different national definitions get in the way of good analysis
  - and of sharing data/analyses.
- Efforts need to be made to collect a core set of data
  - from operations and in exercises
- Guidance on good practice does exist – but practical constraints may prevent its full application.
- Care needs to be taken in comparing data:
  - from past operations to inform current/future operations
  - across different operation types
  - from exercises to operations

… but there is validity in doing so.

Conclusions – Part 4

- There are advantages to sharing data between nations:
  - to build a larger, more statistically-significant data set
  - to understand coalition perspectives
  - to compare and de-conflict evidence.
- But there are barriers which need to be overcome:
  - Terminology and definitions
  - Data archiving
  - Releasability, legal and ethical issues.

Questions?