Safety Science 62 (2014) 366–369

Contents lists available at ScienceDirect

Safety Science

journal homepage: www.elsevier.com/locate/ssci

Discussion

What fatal occupational accident investigators can learn from fatal aircraft accident investigations

Alpo Vuorio [a,b,*], Jarmo Rantonen [b], Christopher Johnson [c], Tapani Ollila [b], Simo Salminen [d], Graham Braithwaite [e]

[a] Health Center Mehiläinen Airport, Vantaa, Finland
[b] Finnish Institute of Occupational Health (FIOH), Lappeenranta, Finland
[c] School of Computing Science, University of Glasgow, Scotland, UK
[d] Finnish Institute of Occupational Health (FIOH), Helsinki, Finland
[e] Department of Air Transport, Safety and Accident Investigation Centre, University of Cranfield, Cranfield, UK

ARTICLE INFO

Article history:
Received 27 March 2013
Received in revised form 5 September 2013
Accepted 11 September 2013
Available online 15 October 2013

Keywords:
Accident
Occupational
Safety
Investigation
Aircraft
Fatal

ABSTRACT

Our aim is to provide an overview of what international aircraft accident investigation practises could teach fatal occupational accident (FOA) investigators. The main purpose of an accident investigation is to prevent future accidents. This aim is easier to achieve if investigations are independent; biases and external pressures can place undue influence on particular recommendations. So far, independence has been easier to achieve in aviation investigations than in fatal occupational accident investigations. In FOAs, tensions often arise between different stakeholders including but not limited to industry regulators, police agencies, industry bodies, trades unions, insurance companies, etc. There are also a host of practical problems that complicate key activities in FOA investigations, including the need to prevent the contamination of evidence in the immediate aftermath of an accident. We argue that greater emphasis needs to be placed on the independence of FOA investigations and that this will help move the emphasis of recommendations from the worker level (sharp end) to the workplace and community system level (blunt end).

1. Introduction

In fifteen European Union countries, nearly 5000 fatal occupational accidents (FOAs) occur each year (Brenner, 2006). In Nordic countries between 2003 and 2008, there were 1242 FOAs (Tómasson et al., 2011), which means approximately 200 FOAs yearly. These accidents have a direct impact beyond the workers, their families and friends. These accidents also cause complex responses in their own organisations and across the industries in which they occur. In spite of the changes that are made each year in working practices and in health and safety regulations, the levels of occupational accidents remains stubbornly high compared, for instance, to aviation accidents. This paper explains these differences in terms of the investigation practices that distinguish fatal occupational accident enquiries from those that guide aircraft accident investigations. Even though the contexts are very different, we argue that much is to be gained if occupational accident investigations build on recommend practices from international (fatal) aircraft accident investigations.

One reason for learning from other industries is that many FOA investigation techniques have remain unchanged over many years (Tómasson et al., 2011). Some aviation investigation agencies have a comparable heritage; the UK Air Accidents Investigation Branch can trace its roots back to 1915. However, initiatives to increase the professionalism of aircraft investigations can be traced back to International Civil Aviation Organisation (ICAO) initiatives in the 1940s and 1950s, leading to Annex 13 of the Chicago convention (1944). Aircraft accident investigation is advanced especially because of standardised practices. Annex 13 and its derivatives have provided a template for accident prevention concerning across the transportation industries (Smart, 2004; Johnson, 2003).

2. Fatal occupation accident investigations

2.1. Definition of FOA and reporting system

FOA is most often defined as an accident in the course of work leading to the death of a victim. In many countries, the reporting of FOAs is carried out as a co-operative process between labour inspectors, police, employers (Tómasson et al., 2011). Wider stakeholders include members of the public, the press and media, trades union and professional organisations, etc.

* Corresponding author. Address: Mehiläinen Airport, Lentäjäntie 1 E, FIN 01530, Finland. Tel.: +358 505004507; fax: +358 01041400.
E-mail address: alpo.vuorio@gmail.com (A. Vuorio).

0925-7535/$ - see front matter © 2013 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.ssci.2013.09.009

2.2. Investigation of FOAs

The need for greater consistency in FOAs, following the model established by ICAO within aviation, can be illustrated by the differences in practices across Nordic nations, shown in Table 1. In Finland a FOA is investigated by a group having representatives from an insurance company, a trade union, employers' union and in some cases an occupational safety researcher. The aim of the trade union representation is to protect the injured victim from unfair accusations of guilt due to human error. The employer's union representative protects his union members, the managers of the company, from unfair culpability, for example for being solely responsible for the accident. These accident investigations often reach a compromise with the blame for the accident claimed to be due to organisational factors, which are still not investigated in any depth. Thus, organisational factors are the most common causes of accidents cited in FOA reports.

By contrast, in Denmark, the police and the Danish Working Environment Authority (DWEA) (Table 1) investigate all fatal accidents. The only exceptions are traffic accidents, which are only investigated by the police. In Finland, Norway and Iceland the investigation system is very similar.

All these Nordic occupational accident investigating authorities have published national level guidelines.

Our analysis identifies two underlying concerns with these FOA guidelines. Firstly, the aims of occupational accident investigation seem to be focused on the sharp-end. Recommendations tend to urge re-training of operators rather than focusing on the wider organisational context in which an accident occurs; employers are investigated less actively (Hovden et al., 2010). Secondly, the guidelines are not standardised between countries even given the strong cultural similarities between Nordic nations (Dechy et al., 2012). There are further differences between the nations summarised in Table 1 and the work of the HSE in the UK, for example in terms of the definition of reportable events under the UK's RIDDOR requirements, or of OSHA in the United States, where interactions have to be considered between State and Federal agencies during any investigation. These differences are even more marked with countries, such as those in Southern Europe, where FOA investigations are led by a magistrate rather than an investigatory agency. For example, in Italy the local Prosecutors Office will typically open an investigation to determine both individual criminal liability and an organisation's administrative liability. These differences make it difficult to apply the findings of any FOA investigation within one country to industries in another – given that there is little consistency in the methods that are used to identify those recommendations.

3. Major learning points from international aircraft accident investigation – comparison with FOA investigation

3.1. With hindsight judging using systemic thinking – the view matters

Working environments are often seen as relatively simple structures with defined linear interactions (Haddon, 1999; Hovden et al., 2010). This leads to a domino model of accidents and an over-emphasis of single causes. By analogy, investigators are encouraged to look for the first domino to fall (Johnson, 2003). Very often, only one factor explained was the cause to the accident. The situation is examined retrospectively in order to determine if a worker had done something wrong and not followed protocols. This method of investigation views human errors in the same way as it does with machine errors. Usually no attempts are made to understand local rationalities, but rather mechanistically hindsight is used to find that an individual has made a mistake.

More sophisticated approaches tend to see accidents as the result of multiple chains of events with multiple contributory factors. In the recent past it has been accepted that workers' actions have a purpose and if their intended actions do not achieve the desired aims, accidents may happen. Consequently, an error in a linear interaction has been replaced by an error somewhere in the working process itself (Stoop and Dekker, 2012). It seems that gradually the working environment has begun to be accepted as being more complex (Hopkins, 2006).

Workplaces can be seen as a series of complex systems. Accidents are no longer only workers' errors but instead they are seen as symptoms of systems failures (Goh et al., 2010; Lenné et al., 2012; Patterson and Shappell, 2010). In this view, preventive actions should focus on the interactions between system components. In a complex system workers' behaviour could cause an accident, but the accident might also be due to complexity of working environment that leads to unplanned interactions at the system level. This view can lead to conflicts with legal systems that are intended to establish liability and blame. In many jurisdictions, it is impossible to distribute responsibility in a piecemeal fashion across many different individuals who together play a small role in forming the context in which an accident can occur.

The system view has influenced aircraft accident investigation; "Almost all the accidents have involved a complex interaction of inherent human performance characteristics with task demands, environmental events and conditions, and social and organisational factors" (Dismukes et al., 2007). The ICAO recommends that accident reports should: "List the findings, causes and contributing factors established in the investigation. The list of causes should include both the immediate and the deeper systemic causes" (ICAO, 2010). The push towards the explanation of deeper systemic causes has been generated by acceptance and adoption of organisational accident principles (Reason, 1990; Maurino et al., 1998). This systemic approach has also been supported by clear distinctions between the engineering and legal investigation of adverse events. Annex 13 makes it clear that the findings from an aircraft accident enquiry should not be used in legal proceedings; the intention is to avoid any recurrence of an accident rather than to establish blame. This is very different from the FOA investigations mentioned in previous sections where there is often close involvement of legal and police agencies as stakeholders in an enquiry.

Recent reviews have encouraged the use of systems thinking in occupational accident investigations (Hovden et al., 2010). Examples include the investigation of fatal construction industry accidents preceding the Athens Olympic Games (Katsakiori et al., 2008), mining incidents and accidents analysis (Patterson and Shappell, 2010; Lenné et al., 2012) and a hazardous waste fire case study in Western Australia (Goh et al., 2010). Although, occupational accident analyses have frequently targeted the individual worker and served epidemiological monitoring, it has been argued that a systems view offers a deeper understanding of the multiple causes behind accidents (Hovden et al., 2010). In the past, these more sustained analyses are generally only reserved for major accidents, which are subject of quasi-legal inquiries such as government/royal commissions. This raises further practical questions – in particular, whether it is possible to sustain the level of analysis

Table 1
Investigative authorities (Tómasson et al., 2011).

Country	Police	Other investigators
Denmark	Involved	Danish working environment authority
Finland	Involved	Local labour inspectorate[a]
Norway	Involved	Labour inspection
Sweden	Involved	Usually local labour inspectorate
Iceland	Involved	Administration of occupational safety and health

[a] In co-operation with the federation of accident insurance institutions, representatives from trade unions and employer's organisations.