

## **Near-Misses-Line: Visualization of the edge between safety and danger**

**Ying qun Pang** [yingqun.pang@cranfield.ac.uk](mailto:yingqun.pang@cranfield.ac.uk); Elmar Kutsch, Wen-Chin Li, Fabian Steinmann

### **Literature and a theoretical foundation**

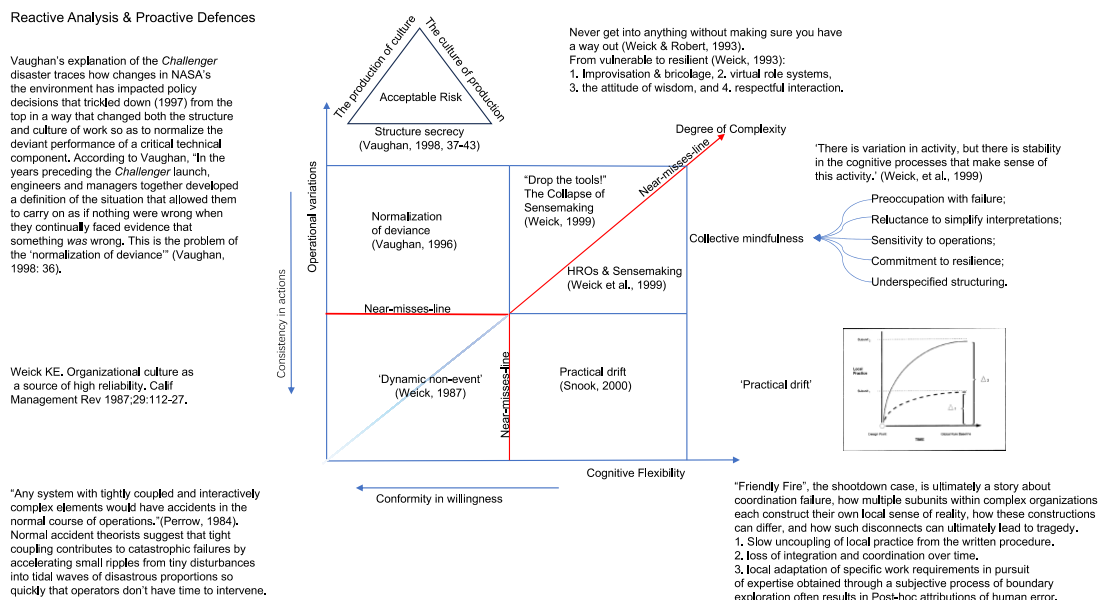
*Weick (2020) argued how a theory is generated. He cited, metaphorically, 'Collage, the art of reassembling fragments of pre-existing images in such a way as to form a new image, was the most important innovation in the twentieth century because it's all been said before' (Shields, 2011, item 44).*

'A near-miss is any event that could have had bad consequences but did not' (Reason, 1990). Near-misses can range from occurrences with a partial success of the mitigating action to incidents in which all the available safeguards were defeated, in the worst case, the serious incidents that missed being catastrophic by only a hair's breadth, but no actual losses were sustained (Reason, 1997). However, at a state level, the investigation will only shed light on accidents and serious incidents. Others, including incidents and occurrences, will be covered by service providers (ICAO, Annex 13). In reality, with the remarkable improvement in aviation safety, we rarely see accidents as resources, but they may happen anytime when people overlook the challenges. On the other hand, near-misses have shown up frequently and alerted people that danger is approaching (FAA, 2023).

In the practical field, near-misses are frequent happened events. From a theoretical perspective, near-misses could be considered as a line to distinguish between safety and danger. A near-misses-line, therefore, separates the potential danger from safe operations. A question arises: how do these near-misses happen? In an ordered world, the opposite of unsafe sees 'reliability as a dynamic non-event' (Weick, 1987). With new technologies and more automation applied, operational rules and procedures have been approved to be an efficient way to improve safety in aviation. Standard Operating Procedures (SOPs) are recognized as being essential to safe aviation operations (APRAST, 2022). Therefore, these rules and procedures structured routine operations. However, it often coexists with conformity and deviates from these rules and procedures (Degani & Wiener, 1994). Even though we do not know how much we don't know, researchers have found some mechanisms from their study on accidents to help people understand similar events that may happen for sharable commonalities. Such as 'practical drift' (Snook, 2000) and 'normalization of deviance' (Vaughan, 1996). These two are similar but deviate in different ways. While 'practical drift' describes that local departments readjust their ways of doing things and differ from the original written rules, 'normalization of deviance' means people overlook changes in the working environment and perform their tasks without adjustments but repeatedly follow the procedures mindlessly.

In between the reliable 'dynamic non-events' world, 'practical drift' and 'normalization of deviance', a near-misses-line represents the boundaries between safety and danger where the near-misses-line is the edge that should be avoided. By relying on the chances of good or bad luck, people may step into danger or, luckily, stay on the safe side. When Weick (2020) argued how a theory is generated, he cited in a metaphor way, 'Collage, the art of reassembling fragments of pre-existing images in such a way as to form a new image, was the most important innovation in the twentieth century because it's all been said before' (Shields, 2011, item 44). In the social psychology society, some researchers have contributed their knowledge to the chaotic world by presenting excellent insights. Such as Weick (2020) listed bibliography in his 1969 book, 'Allport (both Floyd and Gordon), Blau, Garfinkel, Mead

(both George Herbert and Margaret), Perrow, Simmel, and Skinner join one another.’ Weick himself provides a chance to draw out a near-misses-line between his diligent study - the HROs and ‘The Collapse of Sensemaking’. Now, the collage is shaped with four quadrants: 1. The ‘dynamic non-event’; 2. ‘practical drift’; 3. ‘normalization of deviance’; 4. the HROs and ‘the collapse of sensemaking’. Starting from the dynamic non-event sector, the near-misses-line could be approached/crossed through progression towards ‘practical drift’ or ‘normalization of deviance.’ Thirdly, the near-miss line exists between the HROs and ‘the collapse of sensemaking’. Distinct from quadrants 2 and 3, Quadrant 4 consists of HROs occupied with half-quadrants which delve into the cognitive world to exhibit the organizational performance by performing in a collective mindfulness manner. In the other half-quadrant, Weick clarified a dangerous area using the example of a fire-fighting accident in 1949, where nearly all the young firefighters died. The above-described four quadrants represent findings which can be synthesized as a safety analysis model – a ‘reactive analysis & proactive defence model’. See below Figure 1. The analysis of previous incidents and occurrences gives rise to a new model. Although this model may be further refined as more incidents and occurrences emerge, it provides a starting framework to evaluate near-misses.



**Figure 1. A reactive analysis & proactive defence safety model.**

As a DBA researcher in the aviation sector, my focus is examining the ‘edge’ between HROs’ practices and the ‘failure of sensemaking’. The driving question is, “How do flight deck crews navigate a balance between adhering to standard procedures and adapting flexibly to unfolding situations?”

### An outline of the intended contribution to theory and practice

Maitlis & Christianson (2014) suggested that future research on sensemaking should move on to the macro level. This model examines the relationship between consistency in actions versus operational variability (Reason, 2000) by comparing different mechanisms in each quadrant. The model promotes a move from the investigation of individual events at the micro level to the mechanisms underlying the

occurrences at a macro level, potentially moving the strategy of the investigation towards the mechanisms, systems, and organizations. The near-misses formulated into a visualized line from events increased its functionality. This model enables emerged events to be positioned into a suitable quadrant for analysis. The near-misses-line not only benefits integrated risk management but also a line to distinguish transparency from cover-up and distinguish a just or informed culture from a less positive culture. This model benefits investigative bodies by providing insights for future strategy development. Furthermore, this model helps the regulators in maximizing their supervision activities.

Moreover, the model increases organizational learning and allows digging into the root causes without hurting the frontliners. It provides a positive approach to question non-compliance in the fields, whether due to poor procedures or the intervention behaviors of human beings. One local Chinese airline implements categorizing and analyzing operational near-misses to review systems and organizational illnesses. The airline has set up an incentive bonus for all employees to report latent conditions to cultivate an informed culture.

### **An outline of the research question, aim, and objectives.**

The study aims to synthesize insights for professionals at a team level. Potential research questions are: How do the flight deck crew synthesize seemingly contradictory demands by adhering to standard procedures and adapting flexibility to unfolding situations?

### **An outline of the proposed methodology.**

This study uses an experimental design targeting fine-grained data. The simulated scenario is an accident in an Airline in which a flight veered the runway during the second try of landing (Investigation Report B5498). The study focuses on the relationship between mindfulness and attention, interaction and communication at the team level while encountering unexpected events. The proposed methodology will mix non-participatory observations and autoethnography, for example, Whiteman's first-hand autoethnography (Whiteman & Cooper, 2011).

### **A clear philosophical perspective.**

1. Normal Accident Theory (Perrow, 1984). "Any system with tightly coupled and interactively complex elements would have accidents in the normal course of operations."
2. HROs theory (Weick et al., 1999) and sensemaking (Weick, 1995). "There is variation in activity, but there is stability in the cognitive processes that make sense of this activity."
3. At a micro level, collective mindfulness is described as mindful organizing, a social process that becomes collective through the actions and interactions among individuals (Morgeson & Hofmann, 1999).

### **A justification of research design.**

The researcher is an experienced airline captain, instructor and examiner with over 23,000 flying hours. His pre-qualification for the DBA is the MSc in Human Factors in Aviation. The simulators are the most updated training facilities for airline pilots with an equally certified qualification as aeroplanes.