

# ANALYSING THE DIFFERENT ASPECTS OF NEW SAFETY THINKING

Dr. Nektarios Karanikas, CEng, PMP, GradIOSH, MRAeS, MIET, Lt. Col. (ret.)  
Associate Professor of Safety & Human Factors

Aviation Academy

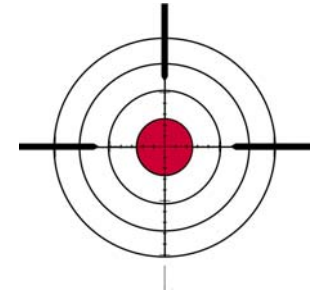
Flight Safety Symposium,  
13-14 September, London  
Heathrow

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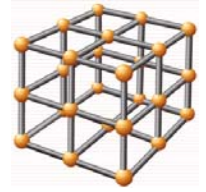
# RESEARCH ON SAFETY THINKING: BACKGROUND AND THEORETICAL FRAMEWORK





# RESEARCH BACKGROUND

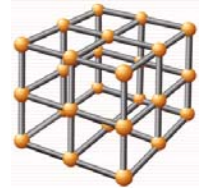
- Evolution in safety thinking:
  - Accident causation models: from root cause, to epidemiological and systemic approaches.
  - New views in human error: from blaming, to understanding end-user's decisions and actions.
- Research question:
  - What is the extent to which current practice has embraced academic thinking in regard to accident models and human error views?



# ASPECTS OF THE ANALYSIS FRAMEWORK: HUMAN ERROR SEEN AS SYMPTOM

Old View	New View
Human Error is seen as the principal cause of accidents.	Need to search for factors that contributed to Human Error.

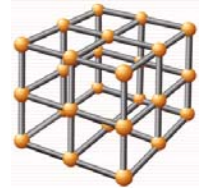
(Dekker, 2006)



# ASPECTS OF THE ANALYSIS FRAMEWORK: HINDSIGHT BIAS AVOIDANCE

Old View	New View
Looking to the event backwards and simply recording errors, inaccurate assessments and wrong decisions.	Consider why choices made sense to users at that time, and what options they had prior to the accident.

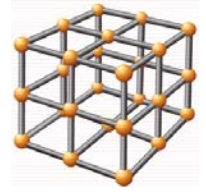
(Dekker, 2006)



# ASPECTS OF THE ANALYSIS FRAMEWORK: SHARED RESPONSIBILITY

Old View	New View
Focus on end-user(s) without exploring influences of other organizational levels.	End-user is not the focal point; organizational factors are also investigated.

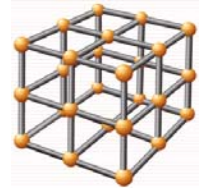
(Catino, 2008; Dekker, 2006)



## ASPECTS OF THE ANALYSIS FRAMEWORK: NON-PROXIMAL

Old View	New View
Shared responsibility might be discussed, but investigators persist on investigating in detail the end-user level.	Proportional investigation depth of all organizational functions.

(Dekker, 2006)

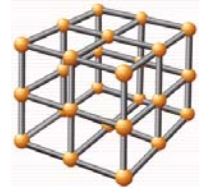


# ASPECTS OF THE ANALYSIS FRAMEWORK: DECOMPOSITION OF FOLK MODELS

Old View	New View
Abstract statements are named as causes (e.g., loss of situation awareness, complacency).	Decomposing and explaining

(Dekker & Hollnagel, 2004; Dekker, 2006)

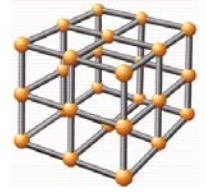




# ASPECTS OF THE ANALYSIS FRAMEWORK: NON-COUNTERFACTUAL

Old View	New View
Merely comparing human performance against standards and procedures.	Exploring the reasons for deviating from standards. Examining the assumptions the standards were based on.

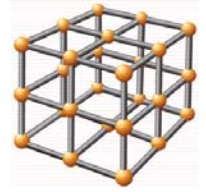
(Dekker, 2006)



# ASPECTS OF THE ANALYSIS FRAMEWORK: NON-JUDGMENTAL

Old View	New View
Actions are compared with norms and expectations (e.g., knowledge, experience and training).	Exploring the reasons for not meeting expectations. Examining the validity of established norms and expectations.

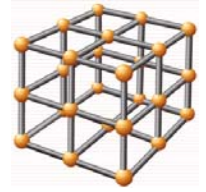
(Dekker, 2006)



## ASPECTS OF THE ANALYSIS FRAMEWORK: SAFETY-II

Old View	New View
<p>Humans are predominantly seen as a hazard. Emphasis is on explaining failures.</p>	<p>Humans are seen as a resource necessary for system flexibility and resilience. Need to explain successes in addition to failures.</p>

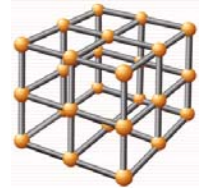
(Hollnagel, 2014)



# ASPECTS OF THE ANALYSIS FRAMEWORK: CONTROL LOOPS

Old View	New View
Feedback mechanisms not systematically investigated.	Feedback mechanisms are considered, so to examine whether/how system control was maintained.

(Leveson, 2011)



# ASPECTS OF THE ANALYSIS FRAMEWORK: ACCIDENT MODELS

	Sequential models	Epidemiological models	Systemic models
Search principle	Specific causes and well-defined links.	Carriers, barriers and latent conditions.	Tight couplings and complex interactions.
Analysis goals	Eliminate or contain causes.	Make defences and barriers stronger.	Monitor and control performance variability.

(Underwood & Waterson, 2013; Hollnagel & Goteman, 2004; Leveson, 2004, 2011; Reason et al., 2006)

# RESEARCH METHODOLOGY

- Method
  - Analysis of safety investigation reports in order to identify statements that represent new safety thinking.
  - In cases of mixture of old and new views on a specific aspect of the framework, the aspect was considered as present.
- Sample: In total 217 safety investigation reports published by the Dutch Safety Board (DSB), Australian Transport Safety Bureau (ATSB), UK Civil Aviation Authority (UKCAA), and Transport Canada (TCA).
- Variables for statistical tests: Time period (1996-2006, 2007-2014), End-user involvement (YES/NO), Fatalities (YES/NO).

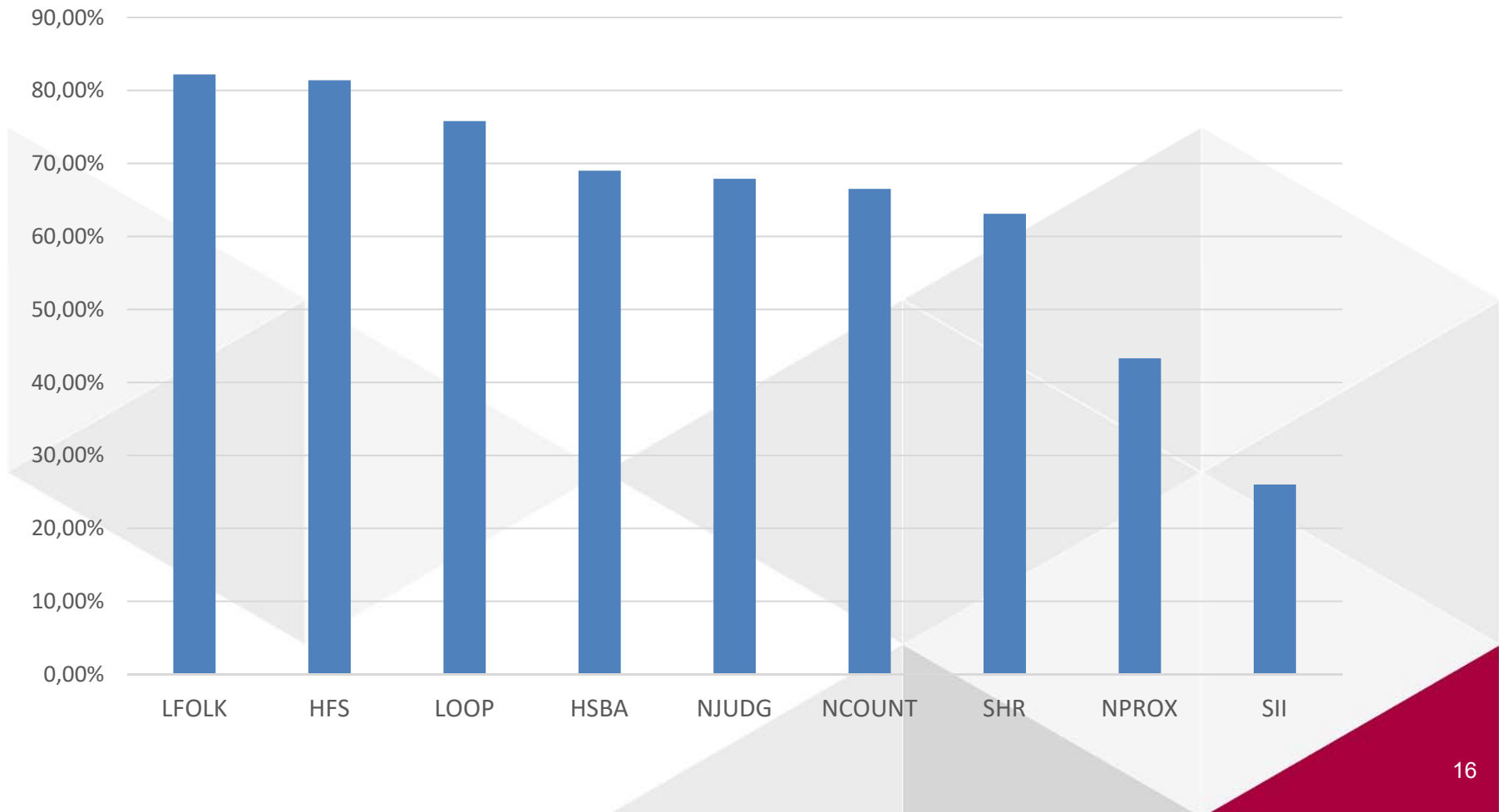
# RESEARCH ON SAFETY THINKING: ANALYSIS RESULTS

[www.international.hva.nl](http://www.international.hva.nl)



# NEW VIEWS ON HUMAN ERROR

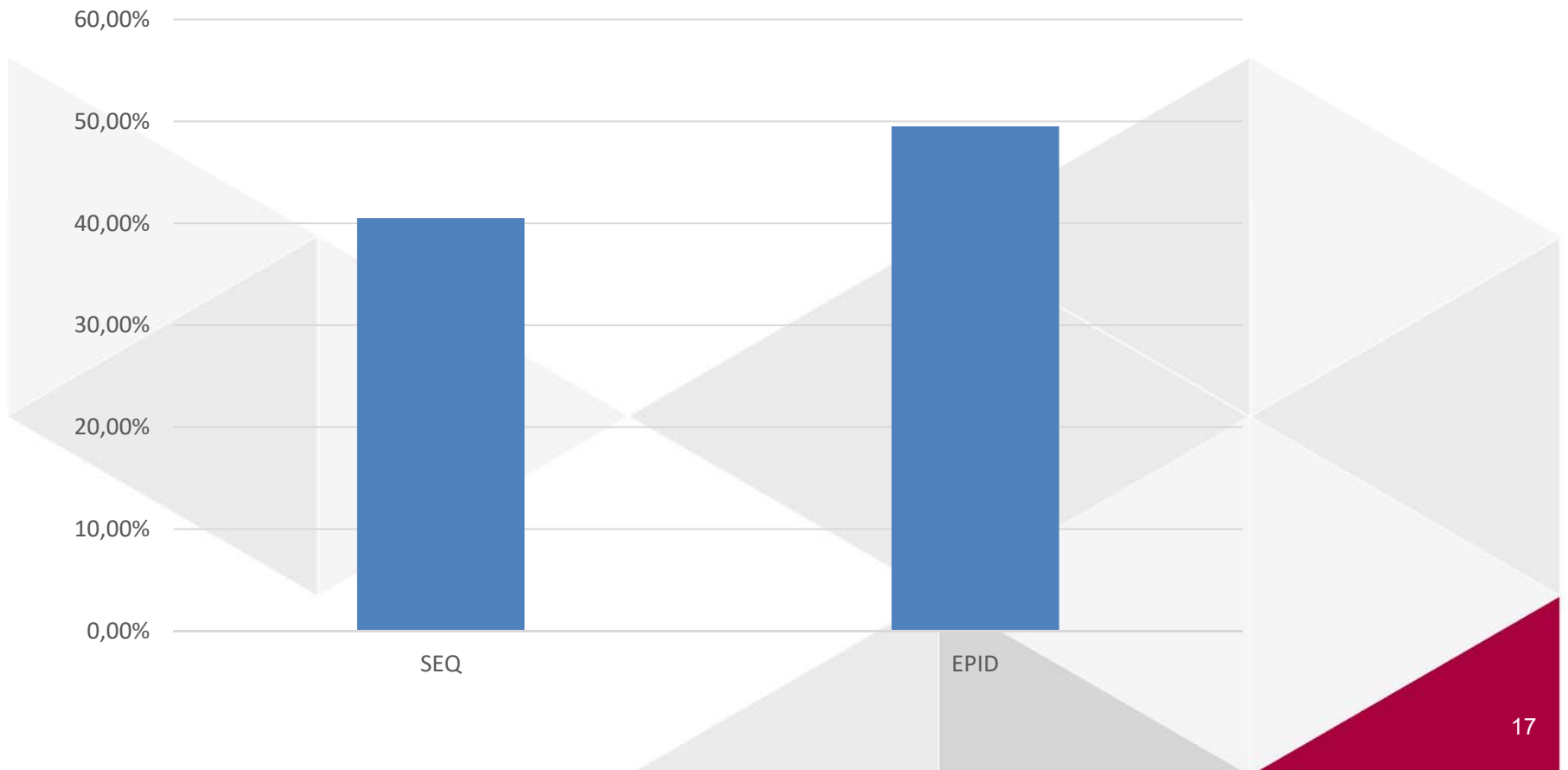
FREQUENCIES OF SAFETY THINKING ASPECTS





# ACCIDENT MODELS

FREQUENCIES OF ACCIDENT MODELS



# SIGNIFICANT DIFFERENCES AMONGST AUTHORITIES

Framework Aspect	ATSB	DSB	TCA	UK CAA
Human Error Seen as Symptom	78%	69%	79%	96%
Hindsight bias avoidance	93%	46%	55%	78%
Shared responsibility	77%	59%	45%	75%
Non counterfactual	82%	66%	50%	66%
Safety-II	53%	14%	13%	28%
Non judgemental	86%	63%	62%	60%
Non proximal	75%	54%	20%	38%

# SIGNIFICANT DIFFERENCES OVER TIME

	Time period with significantly higher frequencies				
Framework Aspect	WHOLE SAMPLE	ATSB	DSB	TCA	UK CAA
Human Error Seen as Symptom				2	
Non proximal		2			
Lack of folk models		2	2		1

# SIGNIFICANT DIFFERENCES FOR END-USER INVOLVEMENT

	Significantly higher frequencies for EU				
Framework Aspect	WHOLE SAMPLE	ATSB	DSB	TCA	UK CAA
Non judgemental	LOWER				
Safety-II	LOWER	LOWER			
Control loops		HIGHER			
Accident model	EPID	EPID			

## SIGNIFICANT DIFFERENCES FOR FATALITIES

	Significantly higher frequencies for fatalities				
Framework Aspect	WHOLE SAMPLE	ATSB	DSB	TCA	UK CAA
Shared responsibility				LOWER	
Non proximal	LOWER				
Safety-II	LOWER	LOWER			
Control loops	LOWER			LOWER	

# RESEARCH ON SAFETY THINKING: CONCLUSIONS AND NEXT STEPS

[www.international.hva.nl](http://www.international.hva.nl)



## CONCLUSIONS (1/2)

- The framework can be used for:
  - uncovering the extent to which new views on human error and accident models have been embraced by organizations
  - evaluating the distance between theory and practice
  - assessing differences among authorities, companies etc.
- Epidemiological models are used more frequently than sequential models, a transition to systemic models is not visible.
- Analysis of success not much applied in accident investigation.
- Although authorities recognize the contribution of various organizational factors, there is tendency to analyze mostly the sharp-end.

## CONCLUSIONS (2/2)

- When considering the whole sample:
  - Safety thinking of the authorities considered in the researched has not significantly changed over time.
  - Authorities tend to be more judgmental and address successes less when there has been end-user involvement in the accident course.
  - Safety II, control loops and non-proximal aspects scored lower when the accidents resulted to fatalities.



## NEXT STEPS

- The distance between academia and industry needs to be explained and minimized.
- There relation between human error views / accident models and safety performance needs to be empirically tested.
- Analysis of accidents from more authorities will strengthen the results and identify further differences.

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# Questions?

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