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Lloyd's Register Foundation

Analysis of Accidents in Helicopter Operations: a New Framework

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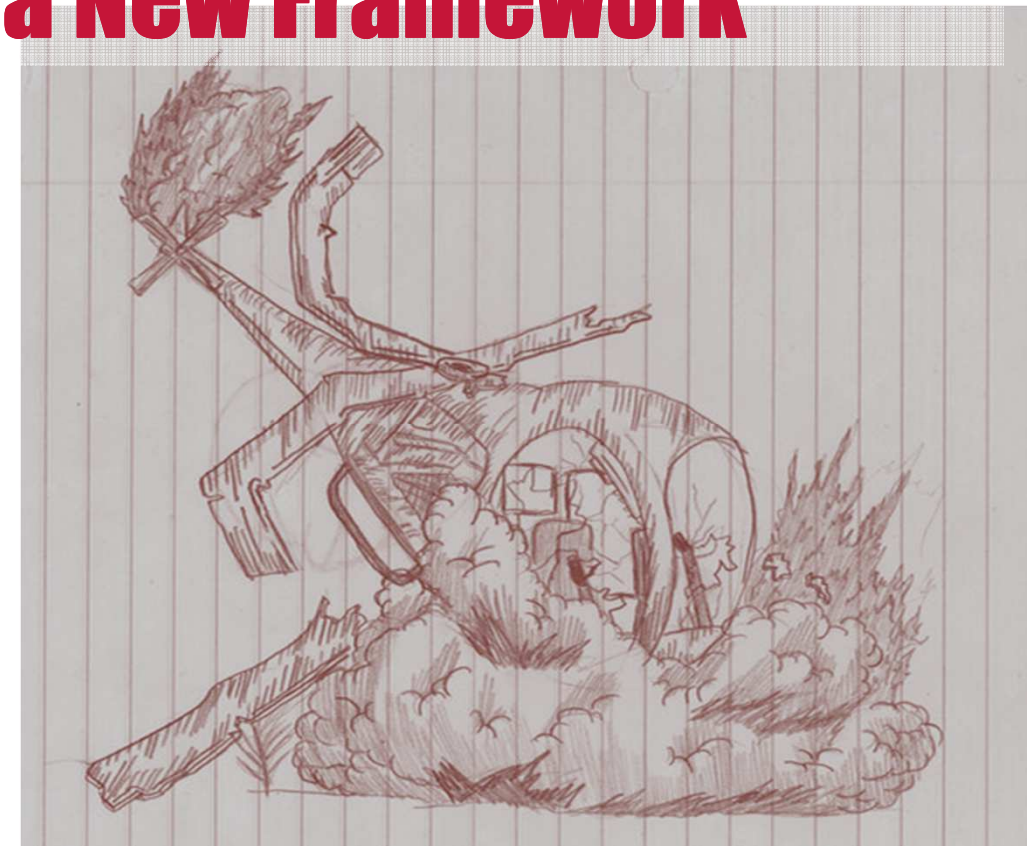

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Presentation plan

Long-term accident analysis

Issues with long-term accident analyses

New accident analysis framework

Framework implementation

Implications

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Long-term accident analysis (1)

Essential tool of Safety Management processes

Long-term analysis of accidents, how do we do it?

(Annex 13, SMM)

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Long-term accident analysis (2)

Adapted from fixed-wing

- IHST
- EHEST

Customised, non-mission specific

- Harris (2006)
- Fox (2002)

Operation-specific, descriptive only

- OGP (1999-2009)

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Issues with long-term accident analyses (1)

Data quality issues

- Scope – definitions
- Timeliness – relevance to present
- Appropriate amount – sample sizes
- Completeness – what are people collecting out there?

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Issues with long-term accident analyses (2)

'an occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, in which

(a) a person is fatally or seriously injured as a result of: being in the aircraft; or direct contact with any part of the aircraft; or direct exposure to jet blast; or

(b) the aircraft sustains damage or structural failure which: adversely affects the structural strength, performance or flight characteristics of the aircraft and would normally require major repair or replacement of the affected component; or

(c) the aircraft is missing or is completely inaccessible.'

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Issues with long-term accident analyses (3)

between the time any person boards the aircraft until such time as all such persons have disembarked

fatally or seriously injured

damage or structural failure

missing or is completely inaccessible

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Issues with long-term accident analyses (4)

Engine failure

Ditching

People get out

Wave destroys the aircraft

INCIDENT

Hostile environments not considered

Doesn’t work for helicopter ditching

Regulations under review

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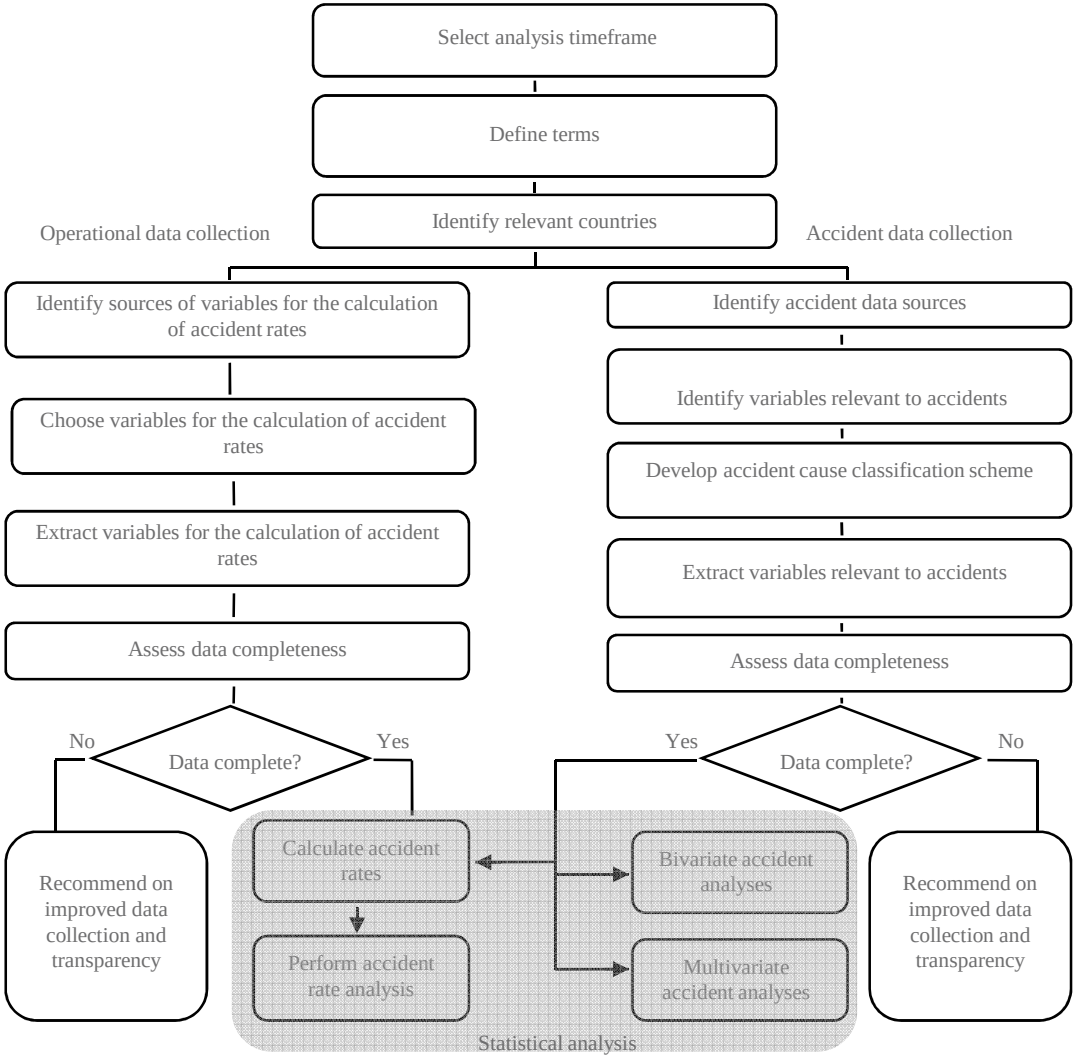
New accident analysis framework: operation specific



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New accident analysis framework: operation specific

Statistical techniques used

- Kolmogorov-Smirnov Z
- Moses Test of Extreme Reaction
- Kruskal-Wallis
- Mann-Whitney test with Bonferroni correction
- Chi-square
- Fisher’s exact test
- Binomial logit modelling
- Multinomial logit modelling

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Framework implementation - offshore helicopter accidents [1]

50 countries

- 44 official accident investigation authorities
- Incidents: AIDS, CADORS, MOR, ATSB

189 accidents

139 variables attempted

- 63 demographics per pilot
- 13 contextual factors (e.g., weather)
- Only 6 complete enough...

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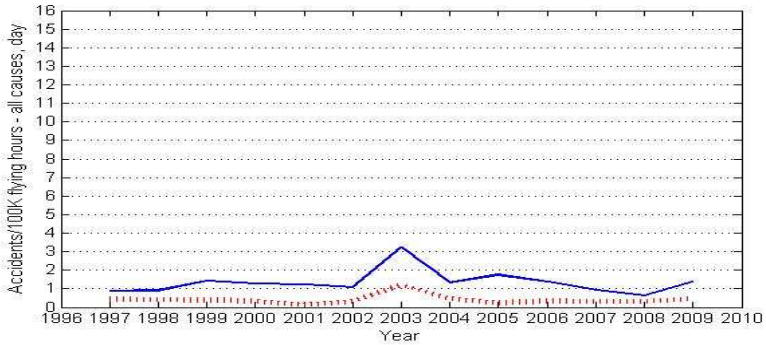
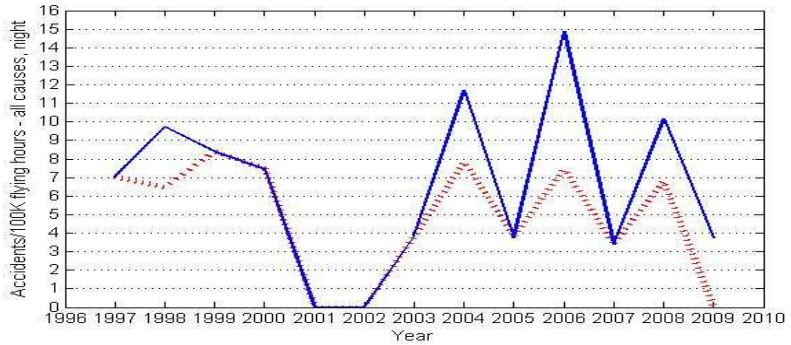
Framework implementation - offshore helicopter accidents [2]

Analysis of accident rates

All causes





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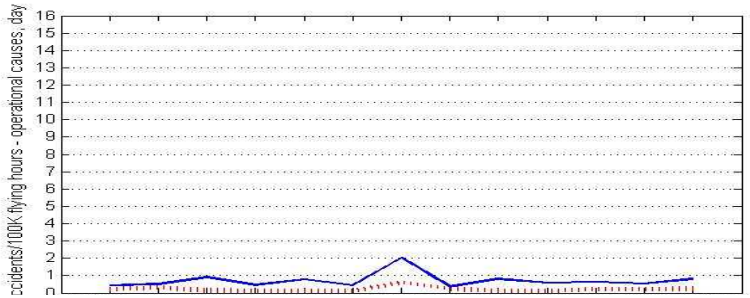

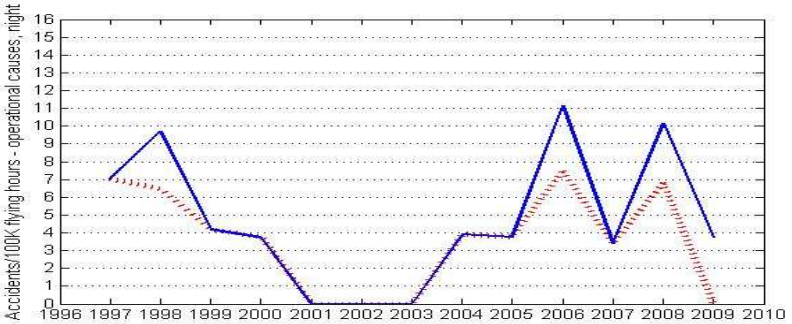

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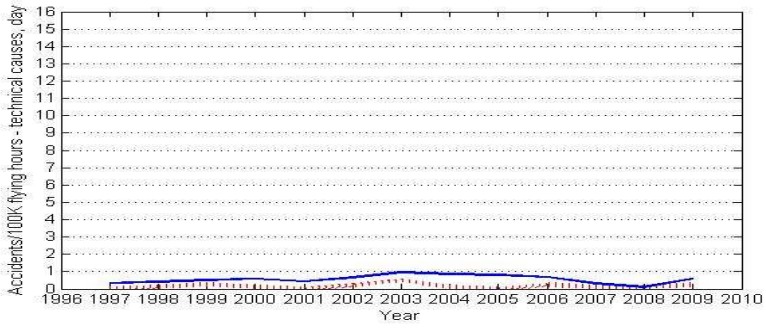

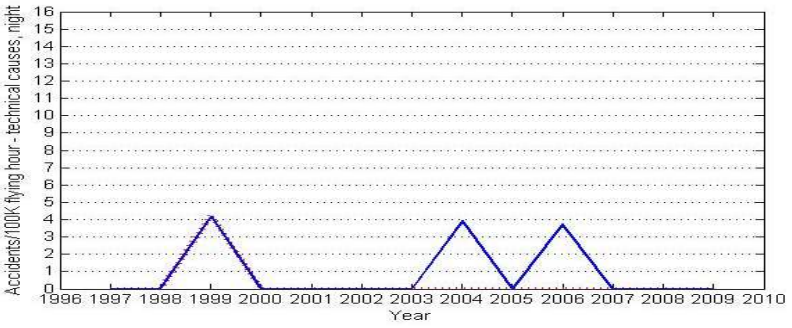

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Framework implementation - offshore helicopter accidents [3]

Bivariate analysis

	Regions	Aircraft categories	Lighting conditions	Phases of flight	Severity (i.e., fatal or not)
Aircraft categories	✓				
Lighting conditions	✓	✓			
Phases of flight	X	X	X		
Severity (i.e., fatal or not)	✓	✓	✓	X	
Causes	X	✓	✓	✓	✓

✓ Significant association X Non-significant association

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Framework implementation - offshore helicopter accidents [4]

Multivariate analysis

Predictions of causes & outcomes

		95% CI for odds ratio		
		Lower	Odds ratio	Upper
Airworthiness versus Pilot-related failures				
Aircraft category	(ME/SE)	0.001	0.024	0.965
Phases of flight	(Arrival/Else)	0.165	0.378	0.866
Aircraft category X lighting condition		1.099	48.038	2099.373

		95% CI for odds ratio		
		Lower	Odds ratio	Upper
Region	Away from GOM	1.318	2.767	5.811
	Away from NS	0.691	2.554	9.444
Lighting		1.584	4.857	14.89

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Implications [1]

Nighttime operations risk

- Africa and Middle East
- Pilot issues (CFITW, obstacle strikes)
- Fatal outcomes

Truly needed?

Daytime operations

- Operational and maintenance at GOM
- Non-fatal at GOM

Explains use of SE? Incident classification?

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Implications [2]

MT helicopters

- Nighttime
- Pilot issues (CFITW)
- Fatal outcomes
- As many deaths as HT helicopters

Over-stretched envelopes? Sea/crashworthiness?

Approach and landing

- Pilot issues (CFITW, obstacle strikes)

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Implications [3]

Incompleteness - prediction suffers

- 82% pilot-related but 53% airworthiness
- 25% fatal outcomes: new safety paradigm needed

Variables not covered – limited view

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Recommended readings

NASCIMENTO, F. A. C., MAJUMDAR, A. & OCHIENG, W. Y. 2013. Helicopter Accident Analysis. *The Journal of Navigation*, FirstView**, 1-17.**

NASCIMENTO, F. A. C., MAJUMDAR, A. & OCHIENG, W. Y. 2013. A 15-year multivariate analysis of worldwide offshore helicopter accidents. *AHS 69th Annual Forum and Technology Display*. Phoenix: AHS.

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Thank you!

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