ASSESSING THE RISK OF LASER ATTACK ON THE UNITED KINGDOM AVIATION INDUSTRY: A CASE OF MILITARY OPERATION

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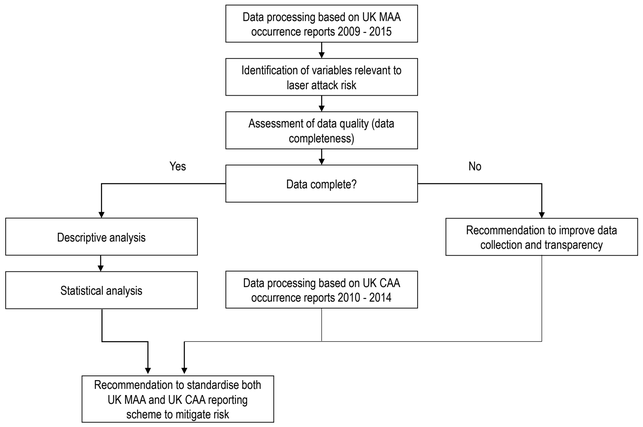
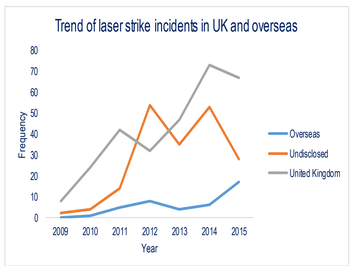
Introduction

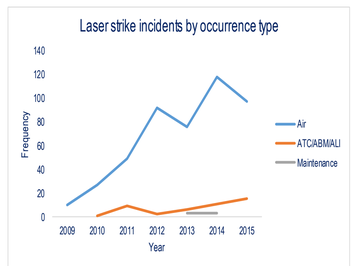
Illumination of aircrafts by lasers, referred to as “laser strikes” in this study, has characteristics that threatens the safety of the aviation industry (FAA, 2013). The ever-growing number of such occurrences has gathered increasing concern of the aviation industry in recent years. This study investigated the UK’s Military Aviation Authority (MAA) data between 2009 and 2015 with the aim to assess how different characteristics of a laser strike event may affect safety performance of an aircraft by evaluating the quality of data provided and subsequently develop mitigation measures to reduce laser associated risks with respect to military operations in the UK. Recommendations were made to improve safety performance of aviation industry by comparing the results of analysis, data quality and reporting scheme of the UK MAA dataset to research findings conducted on a commercial aviation dataset.

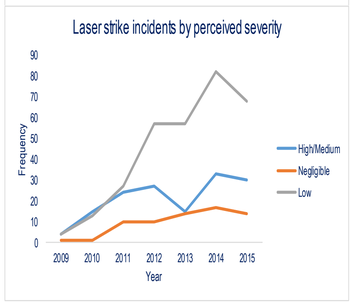
Methodology

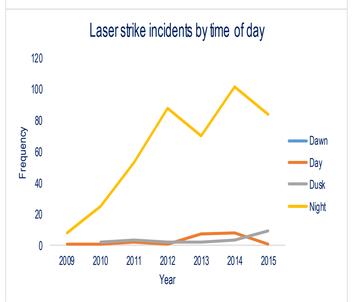


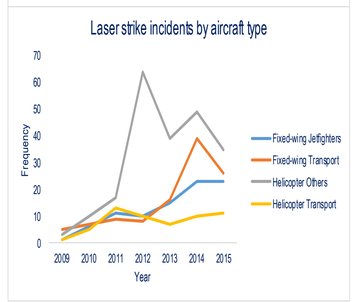
Descriptive analysis











Acknowledgements

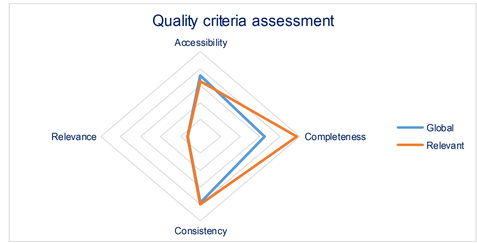
I would like to express my gratitude towards my supervisor Dr. Arnab Majumdar and Dr. Milena Studic who guided me throughout this study. I would also like to thank Paul Taylor from the UK MAA and Dr. Nascimento Filipe from the UK CAA for providing information and insights into the operations of both organisations. This study would not be possible without the UK MAA and the UK CAA’s willingness to provide the relevant data.

Data quality assessment

A methodology developed by Dupuy (2012) is used to assess the suitability of the data for meaningful statistical analysis. Two main components were identified in this methodology: sources of poor data quality and data quality criteria.

Sources of poor data quality	Data quality criteria
Incident reporting scheme	Accessibility
Database structure	Completeness
Incident reporting level	Consistency
	Relevance

	Global	Relevant
Accessibility	72.23%	64.80%
Completeness	64.12%	96.34%
Consistency	78.55%	80.00%
Relevance	13.12%	



Statistical analysis

Chi-square test:

Variable 1	Variable 2	χ2 value	df	p	no of cells with expected frequency of less than 5	Cramer's V	correlation	Assumptions
Aircraft Type	Perceived severity	38.563	6	0	0	0.201	yes	pass
Season	Aircraft Type	5.371	9	0.801	0	0.061	no	pass
Occurrence Type	Time of Day	66.232	9	0.000	11	0.215	yes	fail

Ordinal logistic regression test:

Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test			Exp(B)	95% Wald Confidence Interval	
			Lower	Upper	Wald Chi-Square	df	Sig.		Lower	Upper
Threshold P (< High/Medium)	0.025	0.316	-0.595	0.645	0.006	1	0.937	1.025	0.552	1.906
Threshold P (< High/Medium + Low)	3.175	0.350	2.489	3.862	82.128	1	0.000	23.939	12.046	47.573
Fixed-wing Jetfighters	2.100	0.354	1.406	2.795	35.121	1	0.000	8.170	4.079	16.365
Fixed-wing Transport	1.309	0.330	0.662	1.956	15.742	1	0.000	3.702	1.939	7.068
Helicopter Others	1.087	0.298	0.503	1.670	13.307	1	0.000	2.964	1.653	5.315
Helicopter Transport	0a	.	.	.	.	.	.	1	.	.
(Scale)	1b									

Comparison with civil aviation data:

UK MAA		UK CAA	
Variables tested	Associations	Variable tested	Associations
Occurrence type vs time of day	yes	Quarter of the year vs population density	yes
Aircraft type vs perceived severity	yes	Quarter of the year vs type of mission	yes
		Type of mission vs population density	yes

Reporting scheme	UK MAA	UK CAA
Laser colour variable	No	Yes
Phase of flight variable	No	Yes
"Just" Culture	No	Yes
Resubmission	No	Yes

Recommendation:

1. Improve data capturing by mandating variables such as location of occurrence, phase of flight and colour of illuminating beam;

2. Provide clear guidelines to occurrence reporters (e.g. definition of perceived severity has to adhere to a guideline);

3. Promote stricter requirements on occurrence reports to be received; updated versions that adhere to stricter standards to be resubmitted if initial report did not meet requirement;

4. Introduce automated data collection method for input of objective information;

5. Establish surveillance measures in areas underlying flight paths.

References

1. FAA. (2013) *Advisory Circular: Reporting of Laser Illumination of Aircraft*. Washington D.C., United States Department of Transportation Federal Aviation Administration.
2. Dupuy, M.D. (2012) *Framework for the analysis of sepraration-related incidents in aviation*. Imperial College London
3. Li, B. (2015) *Analysis of laser strike risk to the UK aviation industry*. Msc thesis. Imperial College London.