Imperial College London

ASSESSING THE RISK TO CIVIL AVIATION FROM LASER ATTACKS

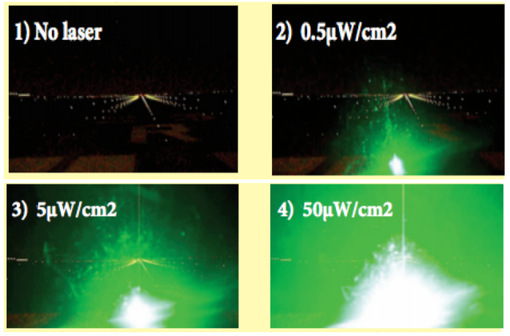
T12

Adrian Cheuk Hei Lee
Department of Civil and Environmental Engineering,
Imperial College London

1. INTRODUCTION

Lasers are important in our world and their use is increasing. They are useful and powerful devices under normal and responsible operations, but misuse of lasers can pose significant threat to the society, especially in an aviation environment. The potential threat of laser attacks depends on factors including: type and power of the laser device, how the laser is operated, phase of flight, flight operation, pilot awareness of laser hazards, time of the year and geographical location. One of the objectives of this study is to deliver a meaningful description and accurate analysis of the MOR data, with a view of assisting the development and implementation of risk mitigation measures that will protect the UK public.

2. BACKGROUND TO LASER ATTACKS IN THE UK



The numbers of reported laser attacks rose from 6 attacks in 2004 to nearly 1400 attacks in 2014. The ever-increasing power output of lasers has increased the hazards of causing eye injuries of aircrew members, air traffic service (ATS) personnel and the Police. It is worth of note that dazzling or distracting the pilot by pointing lasers at an aircraft in flight is an offence under Article 222 of the Air Navigation Order 2009

Figure: No laser illumination (1), bright startle or distraction (at 1000m from source) (2), glare (at 500m from source) (3), and temporary flash blindness (at 100m from source) (4).

3. DATA

In the year of 2014, a total of 1,579 and 332 laser attack incidents, reported under the Mandatory Occurrence Reporting (MOR) Scheme, occurred in the UK and outside the UK respectively, form the data for analysis within the scope of this study. Moreover, to identify the status of key variables not currently discriminated by the MOR form, the narratives of all reports were critically read and re-categorised for further analysis.

4. METHODOLOGY

A framework of the analysis, including data completeness check, descriptive analysis and cross tabulation analysis associated with Pearson's chi-square testing, were developed and implemented to investigate the safety data.

ACKNOWLEDGEMENTS

The UK CAA for the data, and my supervisor Dr. Arnab Majumdar and Dr. Felipe Nascimento for their valuable and constructive advice throughout this study.

5. RESULTS AND RECOMMENDATIONS

The table below summaries the key findings of the analysis. The variables relevant to laser attacks, shown in the table (except for "colour of illuminating beam"), were satisfied with the threshold of 90% for the data completeness assessment.

Characteristic Factors	Key Findings
Location of Occurrence	• Top 3 most frequent laser attack locations in the UK: London Heathrow (184), Manchester (129) and Birmingham (103) • Laser attacks appeared to occur in areas with high populations.
Time of Occurrence	• An average of 132 reported laser attacks per month • Significant increase in laser attacks from May (71) to August (218) • The summer period is well-known for its frequent occurrence of laser attacks.
Type of aircraft	• Fixed-wing aircraft (84.93%) versus rotary-wing aircraft (9.11%).
Type of flight operation	• "Commercial air transport and non-commercial complex" (82.33%) • "General aviation (fixed-wing)" (2.60%) and "Helicopter" (9.12%).
Phase of flight	• During approach phase of flight (61.11%) • During cruise phase of flight (29.89%)
Colour of illuminating beam	• Green laser beam (79.16%)
Month X type of flight operation X geographical location	• Significant association between quarter of month and type of operation. • Significant association between type of operation and population. • No significant association between quarter of month and population.

Possible improvements for the British MOR Scheme, as relevant to laser attack data collection, custody and analysis (Nascimento et al., 2013):

1. More advanced data collection method (e.g. automatic input of objective information).
2. Provide sufficient guidelines to data collectors (e.g. pilots), and promote importance and awareness of laser attack event.

Ways forward to reduce the laser attack risk and mitigate its consequences:

1. Educate flight crewmembers (as well as the public) on the danger of in-flight laser illumination and the mitigation measures to compensate for its deliberating effects.
2. Need additional regulations to defend against careless misuse of laser devices.
3. Implement neighborhood watch programs in areas underlying flight paths.

REFERENCES

Nascimento, F. A. C., Majumdar, A. & Ochieng, W. Y. (2013) *Investigating the Truth of Heinrich's Pyramid in Offshore Helicopter Transportation*. Imperial College London.