LAAG/5/B

Aircraft Accident Modelling for Lydd Airport, Kent

Summary Proof of Evidence (LAAG/5/B)

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1. Introduction

1.1 My name is David Pitfield.

1.2 I have expressed an opinion on this matter in my main statement of evidence based on my qualifications and experience.

1.3 My evidence concentrates on the usefulness and reliability of the AEA (1997) methodology for predicting the aircraft crash risk (commonly referred to as Byrne).

1.4 I understand that Byrne is the method generally adopted by the nuclear industry for inclusion of aircraft crash factors into safety cases, and that it was referred to by the Nuclear Installations Inspectorate when preparing its correspondence to the Shepway District planning authority.

1.5 Although there are newer and better approaches to accident modelling, it has not been possible with the resources available for me to adopt an alternative approach. Instead, I have considered and made adjustments to the Byrne methodology to capture some aspects that relate to Lydd Airport with its intended development, to demonstrate changes in the magnitude of likely aircraft accident risk.

1.6 The overriding aim of Byrne is to predict the frequency of crashes per year onto a nominated target and, for this, there are four main stages in the calculation:

(1) Determine which runway directions are relevant.

(2) Evaluate the overall crash rate (per km^2 per year) at the target site. This is evaluated as the sum of the rates for airport-related traffic and for background traffic.

The background crash rates (i) are taken directly from AEA (1997) and represent overflying aircraft in the vicinity of the target.

The airport related crash rate (ii) is calculated by taking account of the crash probability per movement for each aircraft category, the number of movements by each category, and the location of the target site in relation to the airport. This is determined for each runway direction considered.

(3) Nominate a specific target and its location with respect to LAA and evaluate the effective target area for the site, taking account of its plan area and height.

(4) Multiply the crash rate per km^2 per year by the effective target area to obtain a crash frequency per year onto the target site.

1.6 In my evidence I concentrate on (1) and (2) and particularly the airport related crash rate (2ii).

1.7 Air traffic activity at Lydd Airport today is dominated by light aircraft. Irrespective of the risk of aircraft crash, I am advised that the damage to and consequences arising from a crash of a light aircraft onto the nearby nuclear power stations would, in all probability, be slight.

1.8 The envisaged increase in airport movements of heavier aircraft types to cater for the projected passenger throughput of 500,000ppa, and later 2mppa, will substantially increase crash risk. Since this increased risk of aircraft crash will apply mostly to larger, commercial aircraft then it follows that the damage to the nearby nuclear power stations could be heavy and the consequences higher than those for a light aircraft.

1.9 At and around LAA, there is an unusually high potential for bird strikes given the location of a nearby nature reserve. Also, the need to modify approaches and departure paths due to the location of the nearby nuclear and military sites will result in a higher number of aborted landings for larger aircraft. This will increase the number of 'go rounds' experienced at the airport.

1.10 To evaluate my modified crash rate for the airport I made three necessary revisions:

1.11 **First:** I made an assessment of the relevant runway directions at LAA because I believe three runway directions are relevant, whereas AREVA (2009) in its work for the applicant only chose two. This fundamental error by AREVA demonstrates one element of risk underestimation and, particularly, how easy it is to underestimate risk as a result of not having a thorough knowledge of an airport.

1.12 **Second:** The determination of the airport related crash rate requires the use of a reliability variable (RV) for each aircraft type, being expressed as the number of crashes per movement, denoted as crashes per million movements. The RV values assigned by AEA (1997) for small and large transport aircraft are 1.8 and 0.59 per million movements respectively.

1.13 I consider that Byrne's methodology is flawed in its application because the RV's are derived from statistically insignificant and outdated information.

1.14 Estimates of crashes per movement based on the more recent work of Kirkland et al (2003, 2004) and Wong et al (2009a, 2009b) use more comprehensive aircraft accident databases and confirm that Byrne's reliability rates are too low.

1.15 **Third:** I note that it is impossible to account for the additional risk at LAA due to the complex set of operational circumstances that apply at this airport.

1.16 For example, estimates based on Byrne for two airports with the same aircraft fleet mix, number of movements, runway orientation and distance from the hazard, but with widely different exposure to risk factors such as extreme weather conditions, threat from bird strikes, etc., would produce exactly the same crash rate prediction.

1.17 As I noted previously, the resources available for this evidence do not enable the use of an alternative methodology giving better account of these airport-specific factors but, that said, the application of the Byrne methodology can be improved.

1.18 In particular, a case can be made for increasing accident rates to allow for bird strikes and enhancing landings on runway 21 to account for 'go-rounds. These calculations for airport related crash rates (per km2 per year at the target site) cannot quantify the total risk at LAA but, nevertheless, this does provide an insight into the degree to which Byrne <u>understates</u> risk.

1.19 Referring to the following tables, for this my analysis is based on:

1.20 1) a throughput of both 2mppa and 500,000ppa (Tables 1 and 2 respectively) ;

1.21 2) three runway directions and LAAG's estimates of movements on runway 21 *vs* 03. The adjustments to landing movements on runway 21 are given in the horizontal column.

1.22 3) I used the adjusted reliability values (RV - crashes per million movements) based on the larger database work of Kirkland et al and Wong et al (1st RV entry 1st column – 1.49 and 1.79 respectively) and the adjustments to these figures are given in the vertical column.

1.23 The following tables give the results of this sensitivity analysis:

1.24 TABLE 1 ACCIDENT FREQUENCIES ALLOWING FOR 'GO-ROUNDS' AND BIRD STRIKES, 2 MILLION PPA

	LANDING MOVEMENTS ON RUNWAY 21			
RV = 1.49	0	+1.0%	+5%	+10%
0 for bird strikes	1.55326E-05	1.55548E-05	1.56435E-05	1.57543E-05
+1%	1.56879E-05	1.57103E-05	1.57999E-05	1.59119E-05
+5%	1.63092E-05	1.63325E-05	1.64256E-05	1.65420E-05
+10%	1.70858E-05	1.71102E-05	1.72078E-05	1.73298E-05

	LANDING MOVEMENTS ON RUNWAY 21			
RV = 1.79	0	+1.0%	+5%	+10%
0 for bird strikes	1.86600E-05	1.86866E-05	1.87931E-05	1.89263E-05
+1%	1.88466E-05	1.88735E-05	1.89811E-05	1.91156E-05
+5%	1.95930E-05	1.96209E-05	1.97328E-05	1.98726E-05
+10%	2.05259E-05	2.05552E-05	2.06725E-05	2.08190E-05

1.25 TABLE 2 ACCIDENT FREQUENCIES ALLOWING FOR 'GO-ROUNDS' AND BIRD STRIKES, 500,000 PPA

	LANDING MOVEMENTS ON RUNWAY 21			
RV = 1.49	0	+1.0%	+5%	+10%
0 for bird strikes	6.88584E-06	6.89567E-06	6.93499E-06	6.98414E-06
+1%	6.95470E-06	6.96463E-06	7.00434E-06	7.05398E-06
+5%	7.23014E-06	7.24046E-06	7.28174E-06	7.33334E-06
+10%	7.57443E-06	7.58524E-06	7.62849E-06	7.68255E-06

	LANDING MOVEMENTS ON RUNWAY 21			
RV = 1.79	0	+1.0%	+5%	+10%
0 for bird strikes	8.27225E-06	8.28406E-06	8.33130E-06	8.39034E-06
+1%	8.35498E-06	8.36690E-06	8.41461E-06	8.47424E-06
+5%	8.68587E-06	8.69827E-06	8.74786E-06	8.80986E-06
+10%	9.09948E-06	9.11247E-06	9.16443E-06	9.22937E-06

1.27 These tables demonstrate the influence of my enhancements of Byrne and the inadequacy of the Byrne methodology.

1.28 For example, for the 2mppa of Tables 1 before enhancements to the crash rate RV the accident rate is 1.55326E-05 per km^2 per year based on Kirkland et al, whereas the higher and I would argue more reliable RV of Wong et al increases this to 1.86600E-05 per km^2 per year. In other words, about x1.2 increase of accident rate just from the airport specific risk being derived from a more comprehensive database of accidents.

1.29 Also, I can incrementally increase the enhancements for both greater use of Runway 21 (horizontally to the right) and for bird strikes downwards. Again for the 2mpaa of Tables 1, introducing, say, a 5% increase in bird strike and 1% increase in Runway 21, the overall increase (including for the Wong et al RV) is (1.96209E-05/1.55326E-05=) about x1.26 increase.

1.30 The extreme of my sensitivity analysis, again for the 2mppa case, is (2.08190E-05/1.55326E-05=) about x1.34 increase.

1.31 These and all of my projections of the airport air traffic accident rate are significantly higher than the estimate made by AREVA (2009) of 3.09E-06 per km^2 per year and, accordingly, I consider the AREVA estimate to be unreliable.

2. Conclusions

2.1 My conclusions are that:

2.2 a) overall, Byrne is an inadequate methodology and not a reliable forecaster of airport-specific accident rates; and

2.3 b) the accident crash frequency predictions generated by Byrne for the proposed LAA development with increased air traffic movements, dominated by commercial airliners should be considered with caution.