

SHERIFFDOM OF GLASGOW AND STRATHKELVIN
AT GLASGOW

WRITTEN SUBMISSIONS ON BEHALF OF THE FAMILY OF
GARY LOUIS ARTHUR

in the

FATAL ACCIDENT INQUIRY

into the deaths of

GARY LOUIS ARTHUR
ANTHONY LYNDON COLLINS
JOSEPH ROBERT CUSKER
COLIN GIBSON
ROBERT JAMES JENKINS
JOHN MCGARRIGLE
SAMUEL BELL MCGHEE
KIRSTY MARY NELIS
MARK EDWARD O'PREY and
DAVID IAIN TRAILL

1. On the basis of the evidence heard, the Court should infer that on balance the most probable cause of the crash is:-
 - (i) the CAD showed a mis-reading of fuel in the main and supply tanks,
 - (ii) this led Captain David Traill to discount the LOW FUEL warnings as unreliable, and
 - (iii) the erroneous information from the manufacturer that there would be a 3-4 minute time lapse between flameouts may have contributed to Captain Traill's decision

2. The family of Gary Arthur shares the frustration expressed by the AAIB investigators at the lack of information available to them in the course of their investigation (Wivell 4:52:23). The lack of a voice data recorder or video recording equipment in the cockpit means that there is no indisputable evidence of the events that took place in the cockpit leading up to the crash. Neither is there any direct evidence of what readings were being displayed on the CAD. The Court must therefore infer, from the evidence it has heard, the likely sequence of events leading up to the crash.

Outline of the most logical and plausible scenario

3. The most logical and plausible scenario which can be posited for what took place aboard G-SPA0 is as follows:

The information on the CAD was unreliable possibly due to similar faults to those present on G-NWEM, G-POLD and G-SASA. Until the crash and G-NWEM (November and December 2013 respectively) pilots had no reason to question the accuracy of the fuel indications on the CAD. These readings were trusted and relied upon by pilots (Rooney 25:112:20-24; 25:113-114) and consequently contradictory LOW FUEL warnings may have been treated as unreliable. The Court has heard evidence that not all pilots knew the low fuel warning should take priority (Trott 28:25:5-6) and there is conflicting evidence as to whether pilots were aware the fuel caution and low fuel warning systems operated separately (Taylor 24:119:22 - 24:120:5). This led not only the pilot but to the two experienced Air Observers, to proceed in flight with routine tasks on the erroneous basis that there was enough fuel in each supply tank to sustain the flight. The alternative to this scenario is that the CAD was functioning correctly and all three on board ignored LOW FUEL warnings for no reason whatsoever. This alternative is on any view inexplicable and highly improbable.

4. It has been accepted by the manufacturer that there was a mistake in the Eurocopter System Description Section (CP 290 ep317) where it erroneously claimed that in the event of an engine flameout due to fuel starvation, the pilot could expect the remaining flight time of engine 1, under OEI conditions, to be approximately 3 – 4 minutes. This information had been communicated to pilots (Rooney 25:117:2-3, Mortimer 26:148:17), prior to the crash. It was suggested that the error was an obvious one which pilots ought to have realised, based on

the difference in capacity of the two supply tanks. Captain Rooney at the time of the crash, did not question the 3 – 4 minute figure and thought the discrepancy between this figure and the capacity of the supply tanks might have been explained by the difference between usable and unusable fuel (25:118: 5-24 and 25:119:1-8). This error was not obvious enough for the manufacturer to pick up on when they published (and presumably proof read) the manual. We have heard evidence that around the time of the crash pilots understood there would be 3 – 4 minutes of flying time under OEI conditions before the second engine flamed out. It is likely that Captain Traill considered that if the LOW FUEL warnings were not unreliable, then he would have approximately 3 – 4 minutes to land the helicopter in the event of an engine flameout. It is possible that this erroneous belief may have contributed to his decision that the low fuel warnings could be treated as unreliable.

A more detailed look at this scenario

5. The fact that the AAIB found no evidence of the fuel contents display system operating incorrectly does not assist the Court in determining whether or not the CAD was functioning correctly. The fuel readings on the CAD were not recorded in the Non-Volatile Memory and accordingly we will never know what information (fuel indications and cautions in particular) was displayed to Captain Traill in the lead up to the crash and how this information may have influenced the decisions he made in piloting the helicopter.
6. However, if the CAD was functioning correctly when the LOW FUEL warnings came on, Captain Traill (and the Air Observers) would have seen 73kg of fuel in the main tank and both supply tanks depleting. It is inconceivable that in that scenario Captain Traill would have ignored the procedure laid down in the Flight Reference Cards (FRCs – CP 66 ep22). It would have been glaringly obvious that fuel was not being transferred from the main tank to the supply tank and that the reason for this was that the transfer pumps were switched off. Indeed, if the CAD was functioning correctly there would have been displayed on the CAD both the F PUMP FWD and F PUMP AFT cautions confirming that the transfer pumps were not processing fuel. It is inconceivable in this scenario that Captain Traill would not have turned the transfer pumps back on.

7. It is also very likely that the Air Observers, who would have been able to see the fuel indications on the CAD and would also have seen and heard the LOW FUEL warnings, would have understood there was a problem with fuel getting from the main tank to the supply tanks. In line with the evidence we have heard in relation to Crew Resource Management it is very likely that they would have voiced any such concerns to Captain Traill, particularly given the experience of Mr Collins. Had any such concerns been raised when the LOW FUEL warnings went off (repeatedly) then Captain Traill would have landed the aircraft, or at the very least proceeded to return immediately to Glasgow City Heliport to execute a landing within 10 minutes of the commencement of the LOW FUEL warnings. For these reasons the Court should infer that the CAD was not functioning correctly and displaying the correct levels of fuel.
8. If the CAD was functioning correctly there is no explanation as to why Captain Traill failed to follow the procedure set out in the FRCs. There is no explanation for why Captain Traill would fail to check the fuel transfer pumps were on and thereafter turn them on. There is no explanation for why Captain Traill would chose not to land the helicopter within 10 minutes as directed by the FRCs and instead consider it appropriate to continue to undertake routine tasks in Bothwell, Uddingston and Bargeddie. For all of these reasons it can be inferred that the CAD was malfunctioning.
9. The following potential scenario requires an assumption to be made that the CAD was displaying false fuel content indications similar to those observed on G-NWEM, i.e the supply tanks appeared to remain full with the main tank decreasing despite the transfer pumps being switched off (CP 327 ep65 para1.16.2).
 - (i) At Dalkeith, due to the pitch and attitude of the helicopter, the forward transfer pump became exposed for a period of three minutes and this caution was displayed on the CAD. Captain Traill followed the procedure set down in the FRCs and turned the forward transfer pump off. This is inconsistent with the tests carried out by the AAIB and Airbus but consistent with the observation of Captain Trott (see paragraph 15 (xvii) to (xxi) below). Captain Traill would have had no reason to turn the forward transfer pump off unless such a caution had appeared on the CAD.

- (ii) At some stage on the journey back towards Glasgow, during which time the helicopter has a nose down attitude, the aft transfer pump became exposed for a period of three minutes and this caution was displayed on the CAD. Captain Traill again followed the procedure set down in the FRCs and turned the aft transfer pump off. Captain Traill, forgot that the front transfer pump was still switched off. This is in spite of the fact that it is likely that the CAD would still have displayed the FWD XFER PUMP caution, which should have alerted him to the fact that he had omitted to turn the forward transfer pump back on again.
- (iii) (Assuming a similar fault to G-NWEM) it is possible that the fact Captain Traill would have observed the contents of the main tank decreasing led him to the erroneous conclusion that the front transfer pump was still on.
- (iv) As with the observations on G-NWEM, no fuel caution was displayed on the CAD, which Captain Traill would have expected to see if the supply tanks were becoming depleted with fuel.
- (v) Around the Bothwell area (assuming the AAIB/Airbus calculations are correct) the first LOW FUEL 1 warning was displayed on the warning unit. The aural gong was activated and acknowledged by Captain Traill. It would be apparent to Captain Traill that this warning was inconsistent with the readings on the CAD.
- (vi) Captain Traill followed the procedure set down in the FRCs and checked the fuel quantity indication on the CAD. The reading on the CAD, due to the malfunction similar to that seen on G-NWEM, indicated there was little or no fuel in the main tank. According to the FRCs the pilot should check the transfer pumps' switches are on and that both transfer pump circuit breakers are in, only if there is a positive fuel indication in the main tank. Accordingly, rather than overlooking this important step to check if the transfer pumps were on, Captain Traill considered there was no point in turning the fuel transfer pumps on because of the CAD's erroneous display of the main tank fuel contents.
- (vii) According to the FRCs, the next step to follow would have been to turn off the air conditioning if it was installed. The following step would have been to switch the Bleed Air off if the outside air temperature was greater than 5 degrees centigrade. G-SPAO did not have air conditioning installed and when the wreckage was inspected the bleeding heat was set to off – see AAIB report (CP327 ep 63, para 1.12.10).

- (viii) It is apparent that Captain Traill did not follow the memory item and perhaps the most important step on the FRC for LOW FUEL 1 or 2 warnings, which was to land the aircraft within 10 minutes. Indeed it would appear that he chose to ignore that crucial step of the procedure.
- (ix) With the CAD malfunctioning (displaying full supply tanks and little fuel in the main tanks) and with the knowledge that at the time the LOW FUEL warnings commenced that he would have had plenty of fuel left in the tanks, it is possible that Captain Traill came to the erroneous conclusion that it was the LOW FUEL warnings which were malfunctioning rather than the CAD. Indeed it is difficult to understand why Captain Traill would have failed to land the helicopter within 10 minutes of the LOW FUEL warnings unless he had reached this conclusion.
- (x) We heard evidence from Captain Rooney (25:154:16 – 25:155:15; 25:174:19 – 25:175:12) about why it might be possible Captain Traill came to this conclusion. This was because of the fact that (a) the LOW FUEL warnings for supply tank 1 was intermittent, going on and off on three occasions before coming on and staying on, on the final occasion; and (b) Captain Traill would have been aware that there was more than sufficient fuel in the tanks to complete the tasks in hand.
- (xi) From the evidence we have heard in relation to Crew Resource Management it is extremely unlikely that Mr Collins (described as a very experienced Air Observer) and Miss Nelis would have been content to carry out routine non-urgent tasks unless they were satisfied that Captain Traill had communicated to them the reasons why the LOW FUEL warnings were incorrect and should be ignored, in a satisfactory way. Had either of the two Air Observers expressed concern or dissatisfaction with Captain Traill's decision to continue with routine tasks in spite of the LOW FUEL warnings, then Captain Traill would have had no alternative other than to land the aircraft within 10 minutes. This would either involve landing as soon as practicable or potentially immediately returning to the helicopter base at the Glasgow City Heliport which would have likely been within 10 minutes flight from when the first (or last non-intermittent) LOW FUEL warning came on.
- (xii) It would appear that at the time of the crash, pilots were not sufficiently aware that the fuel probes which are connected to the CAD display and the thermistors which activate the LOW FUEL warnings are entirely separate

and independent systems. Indeed Captain Taylor confirmed that to be the case in the wake of G-NWEM, i.e. that some pilots knew and some pilots did not know (24:119:22 and 24:120:05).

- (xiii) It would also appear that there was no clear understanding amongst pilots at the time of the crash, that in the event of a divergence between the fuel indications on the CAD and LOW FUEL warnings on the warning unit, that the LOW FUEL warnings should always take priority (Trott 28:25:5-6)
- (xiv) Having come to the erroneous conclusion that there must be a malfunction with the LOW FUEL warnings, this would explain why Captain Traill continued to carry out routine tasks and could have been entirely unaware that the supply tanks were depleting until the first engine flamed out.
- (xv) It seems likely that the first engine flameout would have caught Captain Traill entirely unawares. It also seems likely that he would have considered that if there was a problem with fuel depletion in the supply tanks, he would have had 3 to 4 minutes before the second engine would be likely to flame out (Rooney 25:117:2-11). It would appear that he did not have sufficient time to complete the FRC checklist in relation to a single engine flame out before the second engine flamed out 32 seconds later.
- (xvi) If Captain Traill was caught unawares in relation to both the first and second engine flame out, then this would have made the achievement of a successful autorotation more difficult. We have heard evidence that the collective lever would have to be lowered within 1 or 2 seconds to achieve successful autorotation. It would appear that Captain Traill, despite being caught unawares and taking into account the startle effect he would likely have experienced, successfully managed to recover the rotor speed on two occasions before the fatal crash (CP 1340 ep10 point 3.9)

Test-Fuchs Pumps

10. What is abundantly clear, however, is that whatever the sequence of events were leading up to this accident, a fundamental cause of this accident was the turning off of the transfer pumps. It might be the case that Captain Traill made an oversight in not turning the front transfer pump back on when he turned the aft transfer pump off sometime after he left Dalkeith and was transiting back to the Glasgow area. However, the fact of the matter is that there was no mechanical

necessity for helicopters such as G-SPAO, which were fitted with Test-Fuchs pumps, to ever turn the pumps off in the first place. In turning the transfer pumps off, Captain Traill was complying with the manufacturers instructions contained within the FRCs. From a mechanical perspective, this was an entirely unnecessary procedure which endangered the safety of the helicopter.

11. Common sense will tell you that in the world of human affairs, if you instruct pilots to unnecessarily switch off one or both of the transfer pumps, there is an obvious risk that a pilot might, on occasion, forget to turn these pumps back on. Particularly when there is no caution displayed on the CAD to advise the pilot that a pump, which was previously running dry, has now been re-submerged in fuel. That is not to say that each time such an omission is made by a pilot, an accident will necessarily occur. If a pilot omits to turn one transfer pump on rather than both then it may not cause any fuel issues at all. Similarly if the pilot realises his error, perhaps by seeing the F PUMP FWD and/or F PUMP AFT caution on the CAD and switches the transfer pump(s) back on, then no one would necessarily be any the wiser that such an error had ever occurred.
12. The manufacturer knew there was no mechanical necessity for pilots to turn off the transfer pumps that were running dry in helicopters equipped with Test-Fuchs pumps (Mendick :7:98:8)
13. There is no reason why pilots could not be made aware whether the helicopter they are piloting has Test-Fuchs Pumps (a simple indication somewhere in the cockpit would suffice) and to be instructed to ignore F PUMP FWD or F PUMP AFT cautions if that is the case. Indeed we have not heard any evidence of any scenarios where Test-Fuchs Pumps would require to be turned off (e.g. if they are blocked, etc.). To instruct pilots to turn transfer pumps off when there is no mechanical need to do so is an unnecessary risk and may well have been a contributory factor in the cause of this crash. Clearly, if the fuel transfer pumps had not been turned off on G-SPAO, the crash would not have occurred.
14. Even today there are EC135 helicopters with Test-Fuchs pumps where pilots are being instructed to turn them off when they run dry unnecessarily. At the very least the manufacturers could and should change the FRCs (CP66 ep22) in relation to LOW FUEL 1 and 2 warnings to insert the words “or regardless of fuel

indications if Test Fuchs pumps are installed” after “If positive fuel indication in main tank”

Response to Crown submissions

15. For the sake of brevity we will not repeat what is contained in the Crown submissions and merely confine our responses to observations we have in relation to the various points made. We will also confine our observations to matters which we consider of relevance to the findings of the Inquiry and therefore lack of comment should not be interpreted as an endorsement of the Crown’s position:-

- (i) Para 5 – it is submitted that the court might have some difficulty in adopting all of the findings, causal factors and contributory factors in the AAIB report.
- (ii) In particular in relation to AAIB finding 6 it would be correct to say that there was no direct mechanical evidence from examination of the helicopter post-crash to indicate the fuel contents display system was operating incorrectly. However the court requires to look at all of the evidence in the case and for the reasons we have outlined above in paragraphs 6, 7 and 8, if the fuel contents display was operating correctly then it is impossible to understand why the crew of G-SPAO acted in the manner they did up until the crash. It is submitted that the court would be entitled to infer from the actions of the pilot and the air observers in choosing to ignore LOW FUEL warnings, proceeding with routine and non-urgent tasks and failing to land the helicopter within 10 minutes, that the fuel contents display system are likely to have been malfunctioning in the lead up to the crash.
- (iii) In relation to AAIB finding 7 there is no evidence that the fuel caution caption was displayed on the CAD at any time. We know that in G-NWEM fuel was depleted in the supply tanks without any fuel caution caption being displayed on the CAD.
- (iv) In relation to AAIB finding 8 it is worth emphasising that this is an estimate and cannot be said with certainty.
- (v) It is submitted that in addition to the matters listed in the conclusion section of the AAIB report, there are other findings, causal factors and contributory factors which the court may wish to consider. Specifically

unnecessary instruction from the manufacturers to turn the Test-Fuchs transfer pumps off, lack of low fuel warning training and erroneous information from the manufacturer in relation to the estimated flying time under OEI conditions.

- (vi) Para 12 – it is worth emphasising that the instruction to switch the relevant transfer pump off was given to the pilot regardless of whether there was a mechanical necessity for doing so. Helicopters equipped with Test-Fuchs pumps, such as G-SPA0, had no mechanical requirement to turn the transfer pumps off due to dry running.
- (vii) Para 16 – whilst it is correct to say after the accident at least one of the fuel prime pump switches were found in the ON position the AAIB report pointed out that these switches are not guarded and could have been moved either during the impact sequence or the victim recovery operation, prior to the helicopter being lifted from the building. Therefore the pre-impact position of the prime pump switches could not be verified beyond doubt (CP327 ep98 para 2.2.7.1).
- (viii) Para 22 – this is assuming that the CAD and in particular the fuel probes, are not malfunctioning.
- (ix) Para 24 – this is correct but it is also fair to say that it would appear that a number of pilots around the time of the crash were unaware of this fact (see paragraphs 9 (vii) and (viii) above)
- (x) Para 25 – this is only the case if all systems are operative. G-NWEM was an example of fuel probe failure which led to an over-reading of the fuel levels in the supply tank, a decreasing level of fuel in the main tank and no fuel caution on the CAD despite the supply tanks falling below the levels specified in this paragraph.
- (xi) Para 27 – this makes it easy to understand why intermittent LOW FUEL warnings might cause some confusion or scepticism with the pilot. If these warnings remained on the warning unit so long as the fuel remained within the set range and this was something the pilot was aware of, then intermittent warnings might suggest to the pilot that the LOW FUEL warning system is malfunctioning in some way.
- (xii) Para 32 – states as a matter of fact that both LOW FUEL warnings illuminated before the helicopter reached Bothwell yet Para 30 confirmed that the Warning Unit did not record the times the warnings

came on. It is not known when the first LOW FUEL 1 warning came on or when the LOW FUEL 2 warning came on.

- (xiii) Para 40 – we stand to be corrected but where in the evidence was it said that contamination of the fuel sensors with water was “the most probable root cause”? According to Mr Price the over-reading “could” have been caused by water contamination (Price 15:108:16-25)
- (xiv) Para 45 – similarly, in the lead up to the incident involving G-NWEM, there was no evidence that the fuel contents display system was operating incorrectly.
- (xv) Para 46 – there may be a typographical error in the Crown submissions where it states “47 43 CAD unusable fuel”. 47 and 43 are the amounts displayed on the CAD when the supply tanks are full and this is presumably because the remaining capacity is considered as potentially unusable fuel which the pilot should not take into account when making fuel and endurance calculations. As it transpired in G-SPAO it would appear that from the 49 and 44.5kg capacities of both supply tanks, only 0.5kg of the total amount of fuel was not in fact used.

Crown Appendix

- (xvi) Point 4.1.1 – the Crown state it is unclear whether there was ever any fuel-management reason for either of the transfer pumps to be switched off in the first place. It is inconceivable that Captain Trill would have turned either of the transfer pumps off, unless he had been directed to do so by the F PUMP FWD and F PUMP AFT cautions on the CAD.
- (xvii) Point 4.1.2 – the AAIB and Airbus flight trials were unable to generate a F PUMP FWD caution at a fuel state similar to G-SPAO while flying over Dalkeith. It is submitted that for the reasons given by Mark Prior (referred to at Point 4.1.7) and Captain Trott (referred to at Point 4.1.6) the results of the AAIB and Airbus flight trials are flawed and should not be relied upon.
- (xviii) Point 4.1.3 – it is submitted that the Crown have placed too much weight on the Airbus flight trials. The AAIB generated a F PUMP AFT caution in the circumstances described which was endorsed by Mr Prior. Accordingly it is very likely (as opposed to “at least possible”) that the F

PUMP AFT caution was triggered at some point during the transit back from Dalkeith. Again it is inconceivable that Captain Traill would have turned off the aft transfer pump without having received such a caution on the CAD.

- (xix) Point 4.1.6 – it is incorrect to state that the fuel Captain Trott had on board G-BZRS was “considerably less” than the figure estimated by the AAIB for G-SPAO. It was 9kg less. The fact of the matter is that having read the AAIB report Captain Trott was sceptical of the AAIB flight trials and their inability to generate the F PUMP FWD caution when they attempted to replicate the flying conditions for G-SPAO over Dalkeith. Captain Trott took it upon himself, when the opportunity arose, to test that aspect of the report for himself. In very similar circumstances with a very similar fuel state to that calculated by the AAIB to be applicable to G-SPAO when it was at Dalkeith, Captain Trott was able to demonstrate that he was right to be sceptical of this aspect of the AAIB report.
- (xx) Point 4.1.7 – it is submitted that the criticisms of the AAIB and Airbus evidence by Mr Prior are valid and explain why AAIB and Airbus were unable to generate the F PUMP FWD caution over Dalkeith.
- (xxi) Point 4.1.8 – it is submitted that it is very likely that the F PUMP FWD caution came on at Dalkeith. It is inconceivable that Captain Traill would have turned off the forward transfer pump without this caution having appeared on the CAD.
- (xxii) Point 4.4.4 – the AAIB finding 8 confirmed this is only an estimate. Para 1.11.6 of the AAIB report (CP327 ep47) confirmed that the calculations were sensitive to the pitch attitude of the helicopter and were subject to the limitations of modelling.
- (xxiii) Point 4.4.5 – it would appear that the Crown are asking the court to place more weight on the estimates made by the AAIB than the AAIB are prepared to place themselves. The AAIB findings and conclusions were not challenged because it was never suggested by the Crown that the timings were capable of being confirmed and were anything other than estimates.
- (xxiv) Point 4.5 – the only conceivable answer to this question is that Captain Traill concluded that the LOW FUEL warnings were spurious.

- (xxv) Point 4.5.1 – as previously stated it would only make sense for an experienced pilot like Captain Traill to ignore the actions detailed in the FRCs, if he had formed the view that the LOW FUEL warnings must have been spurious. If the CAD was correctly reporting the amount of fuel in the main and supply tanks, Captain Traill could not have reached that view. It can therefore be inferred from the evidence that the CAD was displaying readings which were inconsistent with the LOW FUEL warnings and Captain Traill relied on the CAD readings, together with his knowledge that there would have been sufficient fuel in the fuel tank system as a whole, in reaching the erroneous conclusion that the LOW FUEL warnings were spurious.
- (xxvi) Point 4.5.2 – this is an important point. It is equally frustrating for the family members of those who died in this accident that the absence of any voice recordings of what was said in the cockpit or video footage of what took place means that crash investigators lack sufficient evidence to properly understand the reasons for the accident taking place. It would appear that little or no progress has been made since recommendations to install such equipment were made in respect of previous accidents and from the family's perspective, this is difficult to understand. There is a danger that no lessons will be learned from this and previous accidents. Unfortunately history is almost bound to repeat itself. At the very least the family of Gary Arthur would wish to prevent other families in the future from facing similar unanswerable questions due to a lack of information of what exactly took place in the cockpit before some future air accident.
- (xxvii) Point 4.5.5 – it is agreed that the Crown have put forward no plausible explanation for the accident.
- (xxviii) Point 4.6.3 – the Crown have built up a level of expertise and understanding of the workings of the fuel system of the EC135 during the course of their investigations. However, the Crown should not assume that this knowledge that they have acquired was also known to pilots at the time of the accident. If pilots were unaware that the fuel probes which displayed the fuel levels on the CAD were independent from the LOW FUEL warnings (Taylor 24:119:22 and 24:120:05), then it should not be assumed that pilots would be aware that the LOW FUEL 1 and LOW FUEL 2 warnings were necessarily independent of each other.

To the best of our knowledge no pilot was asked about their understanding of the independence of these two warnings and therefore the Court has heard no evidence about that. It is therefore not correct to state that a pilot would or even should have been aware that each LOW FUEL warning would have reinforced the genuineness of the other. Neither is it correct to state that any doubts Captain Traill had in relation to LOW FUEL 1 ought to have been removed by the appearance of LOW FUEL 2. The Court has heard no evidence about what a pilot's state of knowledge would likely have been around the time of the crash.

- (xxix) Points 4.9.1 to 4.9.4 – we would submit that there is considerable merit to each of the points made by the Crown in each of these paragraphs.
- (xxx) Point 4.9.6 – it is worth pointing out that in both the G-NWEM incident which took place about 2 weeks after the crash and the G-POLD incident which took place on 13th March 2018, no evidence of water contamination was found (Notice to Admit 2). However, both incidents involved erroneous fuel indications.
- (xxxi) Point 4.9.7 – it is respectfully submitted that the Crown have overstated Mr Mendick's position in relation to the finding of water in the main tank (or lack thereof). What Mr Mendick did state was if there had been an emulsion there would have been some water droplets remaining and "some water should have been found" (7:96:11). Although Mr Mendick agreed that emulsion would have left a trace somewhere in the fuel system as a whole (7:97:4) he did not state categorically that this trace would have been found, rather he stated "water should have been found in the main tank".
- (xxxii) Point 4.9.11 – it is worth noting that both G-NWEM and G-POLD also appeared to have a correctly functioning CAD at the start of their flights.
- (xxxiii) Point 4.9.15 – there is no evidence that Captain Traill did not check the transfer pumps were turned on. If the CAD was mis-reading in circumstances similar to G-NWEM then it is entirely possible that Captain Traill deliberately did not turn the transfer pumps on due to these erroneous fuel indications.
- (xxxiv) Point 4.9.16 – the evidence of Captain Rooney was to the effect that before G-NWEM he would have trusted the fuel readings on the CAD

(25:112:20-24; 25:113-114). He also said that as a pilot you are not necessarily aware of precise timings (Rooney 25:138:23 – 25:139:2). If this evidence is correct then it seems unlikely that Captain Traill would have had any reason to question the readings on the CAD. The Crown have proceeded in this point and subsequent points on an erroneous basis. The FRCs only requires the transfer pumps to be turned on if there is a positive indication in the main tank. If there is little or no fuel shown in the main tank on the CAD then Captain Traill in following the FRCs would not be instructed to turn the transfer pumps back on again. If Captain Traill believed these fuel readings to be correct then there would be no reason to turn the transfer pumps on.

- (xxxv) Point 4.9.17 – again the Crown proceed on the erroneous assumption that if Captain Traill had checked the transfer pumps he would have realised that the LOW FUEL warnings must have been genuine. This is incorrect and entirely depends on what was being displayed on the CAD.
- (xxxvi) Point 4.9.19 – without evidence of what was actually being displayed on the CAD at any given time in terms of fuel indications, it is not possible to state with any degree of certainty that the pilot would have been aware of further anomalous fuel indications. No evidence was led from any of the expert witnesses to confirm the likelihood of anomalous fuel indications in the event that the CAD was misreading the fuel contents.
- (xxxvii) Point 4.9.21 – Mr Mendick was not asked about whether he would expect to see a FUEL QTY FAIL caution if the fuel probes were malfunctioning in a similar way to G-NWEM. The Crown cannot effectively give expert evidence in the course of their written submissions.
- (xxxviii) Point 4.9.22 – to the best of our knowledge no evidence was led to the effect as mentioned in this point. If this was an important part of the Crown case then expert evidence should have been led on this matter in order that the appropriate experts could express an opinion on this hypothesis. The Crown were fully aware of the effects of the mis-readings on G-NWEM and at no time suggested to any of the expert witnesses that this malfunction could only have lasted for a maximum of 15 minutes. In any event, there is no evidence that Captain Traill was not

fully aware of the fact that the transfer pumps were not on and as stated previously it may well have been the case that Captain Traill intended to have the transfer pumps switched off due to the fact that the CAD was erroneously informing him that there was little or no fuel in the main tank

- (xxxix) Point 4.9.23 – it is submitted that this point is conjecture, speculation and supposition. No expert evidence was led in relation to these matters. It is submitted that for the Crown to found on this hypothesis without any proper basis in evidence and without the opportunity for any of the experts to express an opinion on these matters renders this hypothesis essentially without value. If the CAD was mis-reading similar to G-NWEM with the supply tanks reading as full and the main tank under-reading there is no way of knowing how inconsistent or otherwise these readings might be with the pilot's own calculations.
- (xl) Point 4.9.24 – again we have heard no expert evidence on this point in the context of a similar malfunction as experienced by G-NWEM.
- (xli) Point 4.11.1 – for all of the reasons mentioned above, a failure on the CAD is the only realistic explanation for why Captain Traill would consider the LOW FUEL warnings to be spurious and to decide to ignore the procedure on the FRCs.
- (xlii) Point 4.13 – the fact that there was 32 seconds between the first and second engine flameout demonstrates that fuel must have spilled over between the two supply tanks when the fuel level was close to the top of the fence. If the average fuel consumption under OEI conditions is 2.25kg per minute then that would suggest that there was approximately 1kg of fuel difference between the two supply tanks. Accordingly, if another half kilo of fuel had sloshed over the fence then G-SPAO could have experienced near simultaneous engine flameouts. It would certainly have the appearance that a foam insert to differentiate the capacity of the two supply tanks by either 4 or 4.5kg of fuel is not as robust a design for preventing simultaneous double engine flameouts as might first appear.
- (xliii) Points 5.2.3 and 5.2.4 – if there was a caution to alert the pilot that that a fuel transfer pump had been re-submerged in fuel then this may have prompted Captain Traill to turn one or both of the fuel transfer

pumps back on and thus avoided the crash. In G-NWEM the fuel caution was not working.

- (xliv) Point 5.3.1 – there was no evidence that for reasons of efficiency or maintenance it would be desirable to turn off dry running Test-Fuchs pumps.
- (xlv) Point 5.3.3 – even with existing avionics there is no reason why pilots should not be able to distinguish separate procedure for those helicopters with Globe pumps and those with Test-Fuchs pumps. It should easily be possible for a notice or indication to be displayed in each helicopter to show which pumps are fitted. We heard no evidence that a blocked Test-Fuchs pump would require to be turned off for mechanical reasons.
- (xlvi) Point 5.5.3 – there may have been no evidence to that the accident would have been avoided if the time equivalent of 4kg had been available to the pilot but he would certainly have been in a better position to be ready to initiate autorotation with such a time interval. Of course, had he 3 – 4 minutes between flameouts he would have had sufficient time to land the helicopter.
- (xlvii) Points 6.3.2 to 6.3.6 – we would fully agree with the observations made by the Crown in these points. If, as a matter of course, sufficient training had been given to pilots in relation to LOW FUEL warnings prior to the crash, then it is entirely possible that this accident could have been avoided. It would seem to be extremely unlikely that Captain Trail would have come to the erroneous conclusion that the LOW FUEL warnings were spurious and have chosen not to follow the procedure in the FRCs in full.
- (xlviii) Points 6.3.7 to 6.3.9 – we would fully agree with these Crown submissions.

Recommendations

16. In relation to section 26(1)(b) and (4) of the Inquiries into Fatal Accidents and Sudden Deaths etc. (Scotland) Act 2016 we would respectfully suggest that your Lordship considers the following recommendations:-

- (i) that the manufacturers of the EC135 are directed to introduce a system of working whereby pilots who are flying helicopters installed with Test-

Fuchs pumps are not directed to turn these pumps off, when they become exposed.

- (ii) that greater training is afforded to pilots in relation to LOW FUEL warnings. This would also promote a better understanding of the mechanics of the fuel systems.
- (iii) that a greater training is afforded to pilots in relation to the need and methods of maintaining rotor speed above 75% in order to ensure successful autorotation.

Gordon Jackson QC
Dean of Faculty

Allan Macleod, Advocate