



## PATENTS ACT 1977

CLAIMANTS	Duncan Riach & Anthony Brown
RESPONDENT	Fulcrum Systems Ltd
ISSUE	Application under section 13 in respect of GB2350989
HEARING OFFICER	H Jones

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### DECISION

#### Introduction

- 1 This decision is concerned with the question of who should be named as inventor in UK patent GB2350989 (“the patent”) granted to Fulcrum Systems Ltd (“Fulcrum”). In my preliminary decision on the question of entitlement to the patent issued in September of last year ([BL O/378/13](#)), I found that the claimants had been unable to prove that Fulcrum knew or reasonably should have known that it was not entitled to the grant of the patent and I dismissed their reference under section 37 of the Patents Act 1977 (“the Act”). The claimants have since asked me to decide the remaining issue of who devised the invention set out in the patent, and both sides have said that they are content for me to do so on the basis of the papers filed.

#### Background

- 2 The background details are already set out in my earlier decision, but I shall repeat the pertinent ones here for completeness. The claimants were students at Reading University from October 1992 to July 1995. As part of their final year dissertation project, the claimants were tasked with developing an electronic system to cancel background noise entering telephone handsets in stock exchange rooms. The task was defined by Fulcrum, and the two students met with representatives of Fulcrum in May 1994 to discuss requirements. At the end of their project, they reported their findings separately and concluded that the system they had developed was not able to cancel out background noise completely. Mr Brown noted in his report that the system was particularly good at cancelling repetitive signals such as sine waves and suggested that it would likely be able to cancel other noise such as car engines, machinery hum and emergency service sirens.
- 3 Fulcrum filed a patent application relating to background noise reduction on 12 March 1999. This application eventually gave rise to the patent in question and named David Townsend and Robert Sherratt as the inventors. At the time of filing the application, Mr Townsend and Dr Sherratt were employed by Reading University and were involved in a collaboration project between the University and Fulcrum in which

the University subsequently assigned their intellectual property rights over to Fulcrum. The initial aim of the collaboration project was to design and develop microphone and complementary interface products that address the problems of speech intelligibility in high noise environments. The project ran from May 1997 through to November 1999. The scope of the project was revised over time, as evidenced by various executive reports and notes of meetings between Fulcrum and Reading University. In an executive summary of the project produced by Mr Townsend dated November 1998, the aim of the project was described as the design and development of a product that will allow suppression of siren noise transmitted over a two-way radio link in emergency vehicles.

- 4 The claimants say that they are the true inventors of the noise reduction system set out in the patent and that the patent specification is mostly a summary of the contents of their final year dissertation reports. They claim that they alone should be named as inventors in the patent. Fulcrum deny this: they say that Mr Townsend and Dr Sherratt are the sole joint inventors of the method and apparatus described in the patent and that the claimants' application under section 13 should be rejected.

### **Right to be mentioned as inventor**

- 5 Section 13 of the Act states that the inventor or inventors of an invention shall have a right to be mentioned as such in any published application or granted patent. If a person alleges that someone has been named as inventor that ought not to have been, then that person may ask the comptroller to decide the matter and to have the situation corrected. Section 7(3) of the Act is relevant in that it defines the inventor as being the actual deviser of the invention.
- 6 The approach to be taken in deciding questions of inventorship can be found at paragraphs 20 and 21 of the House of Lords' opinion in *Yeda*<sup>1</sup>, in which Lord Hoffman said:

*20 The inventor is defined in s.7(3) as "the actual deviser of the invention". The word "actual" denotes a contrast with a deemed or pretended deviser of the invention; it means, as Laddie J. said in University of Southampton's Applications [2005] R.P.C. 11, [39], the natural person who "came up with the inventive concept." It is not enough that someone contributed to the claims, because they may include non-patentable integers derived from prior art: see Henry Brothers (Magherafelt) Ltd v Ministry of Defence [1997] R.P.C. 693, 706; [1999] R.P.C. 442. As Laddie J. said in the University of Southampton case, the "contribution must be to the formulation of the inventive concept". Deciding upon inventorship will therefore involve assessing the evidence adduced by the parties as to the nature of the inventive concept and who contributed to it. In some cases this may be quite complex because the inventive concept is a relationship of discontinuity between the claimed invention and the prior art. Inventors themselves will often not know exactly where it lies.*

*21 The effect of s.7(4) is that a person who seeks to be added as a joint inventor bears the burden of proving that he contributed to the inventive concept underlying the claimed invention and a person who seeks to be substituted as sole inventor bears the additional burden of proving that the inventor named in the patent did not contribute to the inventive concept. But that, in my opinion, is all. The statute is the code for determining entitlement and there is nothing in the statute which says that entitlement depends upon anything other than being the inventor. There is no justification, in a dispute over who was the inventor, to import questions of whether one claimant has some personal cause of action against the other.*

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<sup>1</sup> [Yeda Research and Development Co Ltd v Rhone-Poulenc Rorer International holdings Inc & Others \[2007\] UKHL 43](#)

- 7 The question I must answer is who contributed to the inventive concept underlying the claimed invention. A considerable amount of evidence has been submitted by the claimants in support of their case, and I am grateful to both sides for their skeleton arguments in assisting me identify the key documents and witness statements that I need to consider in answering this question.

### **Evidence & Analysis**

#### **a) the inventive concept**

- 8 The invention concerns a method and an apparatus for reducing siren background-noise in voice communication from an emergency-service vehicle. The various elements of the invention set out in the main claims of the patent (claims 1 and 5) are as follows:

a) deriving an input representation of a signal from a microphone within the emergency-service vehicle which contains a voice component together with an interfering component of siren background-noise,

b) combining this input representation with a representation of an estimate of the noise component to derive an output representation of a signal containing the voice component where the interfering component is at least significantly reduced,

c) the representation of the estimate of the noise component being derived by application of finite impulse response (FIR) filtering to a siren-reference input that is derived from a source separate from the microphone, and

d) the filter coefficients of the FIR filtering are adjusted in accordance with values derived from application of a least mean square (LMS) adaptive algorithm to the output representation.

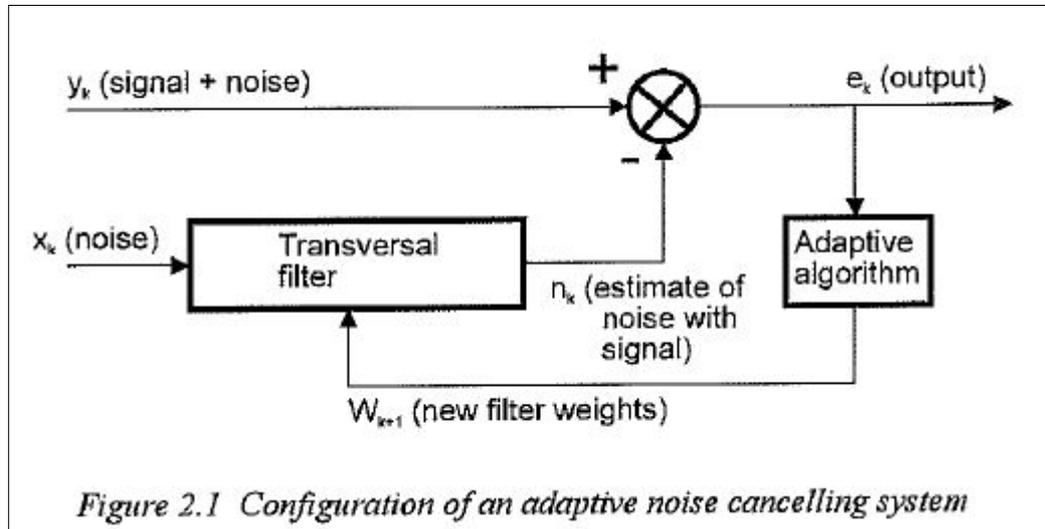
- 9 The inventive concept encompasses all of these elements of the claims, and, as Fulcrum say in their skeleton argument, it can be stated as being the reduction of siren background-noise in output voice-communication from a microphone in an emergency-service vehicle by subtracting an estimate of the background-noise from it, where the estimate is derived by FIR filtering of a siren-reference signal using filter coefficients adjusted in accordance with an LMS adaptive algorithm applied to the output signal. The claimants have not addressed this point directly.

#### **b) who contributed to it**

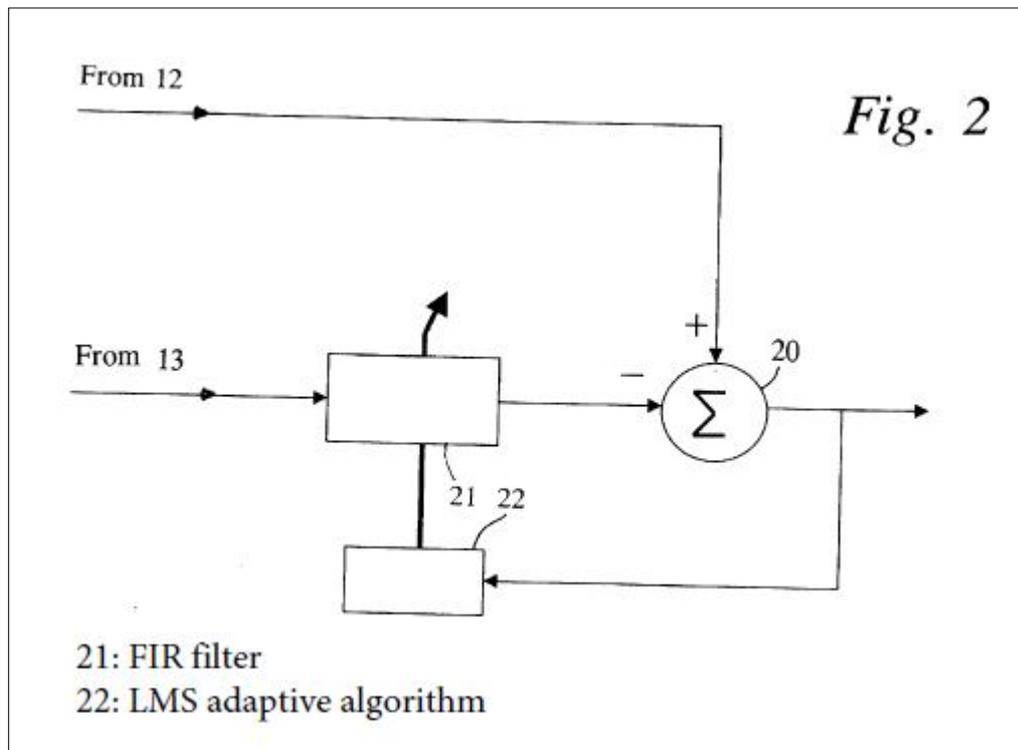
- 10 The key pieces of evidence in support of the claimants' case are the two dissertation reports completed by Duncan Riach and Anthony Brown as part of their joint final year project at Reading University. Mr Riach's report on DSP Noise Cancellation (exhibit DAR11) is dated 1 May 1995 and Mr Brown's report on Adaptive Noise Cancellation for Telecommunications (exhibit APB11) is dated 2 May 1995, i.e. some four years before the priority date of the patent in question. Both reports describe the development and testing of an electronic system to cancel background noise entering a telephone handset in stock exchange rooms, and DAR11 acknowledges that the project was based on the requirements of Fulcrum for a "Universal Handset Interface". DAR11 describes how most adaptive noise cancelling systems with a

reference signal are configured as shown in its figure 2.1, which, for all intents and purposes, is identical to the schematic representation of the noise-reduction apparatus shown in figure 2 of the patent - see below:

From DAR11:



From GB2350989 (where I have added a key to elements 21 and 22):



- 11 The Transversal filter shown in fig 2.1 of DAR11 is described in the associated text as an FIR transversal filter. The report says that the output of the FIR transversal filter is given by,

$$n_k = \sum_{i=0}^{N-1} w(i)x_{k-i} = \mathbf{W}^T \mathbf{X}_k$$

where  $\mathbf{W}^T$  is a vector of filter weights of coefficients,  $\mathbf{X}_k$  is a vector of samples at time  $k$  and  $N$  is the number of filter taps. The output of FIR filter 21 in figure 2 of the patent is given by a nearly identical mathematical equation, namely:

$$\hat{n}_k = \sum_{i=0}^{N-1} w_k(i)x_{k-i}$$

12 Both DAR11 and APB11 explain that the simplest method of reducing noise in the output signal in real-time is to use a least mean squares (LMS) algorithm to adjust the coefficients of the FIR filter. DAR11 acknowledges that the main problem with the LMS algorithm is that of “nonstationarity”, i.e. that it is not effective in filtering random patterns of noise. This is borne out in the final conclusions of the project, as explained in APB11, where failure of the noise-reduction system is said to be due to the rapidly changing characteristics of the speech waveform and the acoustics of the equipment room. For “repetitive noise”, APB11 says that the system is effective in reducing the transmission of a sine wave audible in the background, and suggests that it ought to be effective in cancelling other types of repetitive noise such as car engines, machinery hum and emergency service sirens<sup>2</sup>.

13 The claimants argue that the work they undertook as part of this final year project was the source and foundation of the invention described in the patent and they suggest that the defendant has taken advantage of the fruits of their year of unpaid engineering effort. They argue that the defendant was able to benefit from their efforts in the following way:

a) the subject of the final year project was defined by Fulcrum and Fulcrum would have been aware of the content of the dissertation reports (DAR11 and APB11); Bob Andrews, who was managing director of Fulcrum at the time of the project, was fully aware of the development of the project, he visited the claimants at the University and met with them at Fulcrum’s premises.

b) Chris Guy, who was a member of the academic staff at the University’s Engineering Department at the time of the final year project, was responsible for monitoring and evaluating the project; at the end of the project, the dissertation reports (DAR11 and APB11) were formally submitted to him.

c) after gaining his degree, Anthony Brown was employed by Fulcrum from the summer of 1995 until late 1996.

d) in 1997, Reading University entered into a collaborative arrangement with Fulcrum under the government funded Teaching Company Scheme (TCS); the initial aim of the collaboration arrangement as set out in the TCS grant application form was to design and develop microphone and complementary interface products that address the problems of speech intelligibility in high noise environments; the

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<sup>2</sup> Page 22 of APB11: “If it will cancel sine waves then it seems likely that it will cancel other noise such as car engines, machinery hum and emergency service sirens”

application form was signed by Chris Guy on behalf of the University and by Bob Andrews on behalf of Fulcrum; the Local Management Committee of the project (LMC) included Bob Andrew as Chair, Chris Guy as Academic Leader and Dr Robert Sherratt as Academic Supervisor.

e) the TCS project ran from May 1997 through to November 1999; a patent application relating to background noise reduction was filed by Fulcrum on 12 March 1999; the application named David Townsend and Robert Sherratt as the inventors, and Fulcrum claimed the right to grant of a patent by virtue of contracts of employment and rights arising under an agreement of 3 July 1998 (the agreement being concerned with rights to intellectual property developed as part of the TCS project between Fulcrum and Reading University, and the contracts of employment being the ones between the two named inventors, David Townsend and Robert Sherratt, and the University).

- 14 The defendant does not contest any of the points a) to e).
- 15 The claimants argue that there is a direct link between the work undertaken by them as part of their final year project and the filing of the patent application, with Chris Guy (of Reading University) and Bob Andrews (of Fulcrum) providing the technical and managerial continuity throughout the development of the inventive concept from the claimants' work to the grant of the patent. In addition, the claimants allege that they developed their noise cancelling system without any technical input from Chris Guy or from anyone else at the University. They point to the witness statement of Stephen Sangwine, who was employed as a lecturer in the Department of Engineering at Reading University between 1 January 1985 and 31 December 2000, who states that in 1995, adaptive digital signal processing (DSP) was an advanced level topic usually taught at postgraduate level and that no member of staff, to his knowledge, had expertise in adaptive DSP, let alone in the use of the LMS algorithm. The claimants say that they became aware of the LMS adaptive DSP filtering algorithm from the book "Digital Signal Processing: A Practical Approach", co-authored by Emmanuel Ifeachor of the University of Plymouth, which Duncan Riach discovered and ordered for the project. This book is referenced in both DAR11 and APB11.
- 16 There is a dispute between the parties about when the idea of using the noise cancelling system developed by Riach and Brown to cancel emergency sirens was presented to Fulcrum. However, this link between what Fulcrum knew of the claimants' final year project is not crucial to the claimants' case given the additional connection between the final year project and the patent application in the form of project supervisor, Chris Guy. For completeness, the claimants say that they presented the results of their project to Fulcrum at a demonstration in March 1995 and suggested the use in emergency vehicles at that time. The defendant argues that the witness statement of Anthony Brown implies that the idea did not become apparent to the claimants until after the demonstration when they were writing up their respective dissertation reports. I have read Mr Brown's witness statement and I cannot see where this implication is made. Also, given Chris Guy's role in the TCS project and his knowledge of the claimants' dissertation reports, I do not need to give any weight to the claimants' further assertion that Anthony Brown would have "probably" discussed the project with Bob Andrews after he was hired by Fulcrum, i.e. if Fulcrum did not know the potential applications for the noise cancelling system

beforehand, they would have done so as a result of Anthony Brown's discussions with Bob Andrews.

- 17 The final limb of the claimants' case is their allegation that Chris Guy and Robert Sherratt did not have sufficient knowledge or expertise in adaptive DSP to have developed the idea underlying the inventive concept. They point to the TCS grant application form for the collaborative project dated February 1997 (exhibit DAR17.10) which states that "the technology transfer will include expertise and experience in high speed digital signal processing for active noise reduction", yet the skills and experience listed in the document for Chris Guy and Robert Sherratt do not include the necessary expertise for active noise reduction. They say that when Chris Guy and Robert Sherratt were questioned by the TCS Programme administrators about their lack of expertise in adaptive DSP, they responded by referencing the "close working relationship" between the University and Fulcrum and also of the claimants' final year dissertation project. Their response is provided in a letter dated 26 March 1997 (exhibit DAR17.15):

*"..The active noise reduction system, although audio, requires exactly the same type of signal processing that we at Reading have published and are also currently developing new models for. In the subject of signal processing, the algorithms required are broadly the same no matter what type of signal is being processed. Therefore, although the project is audio, our signal processing skills are fully transferrable.*

*The University has a close working relationship with Fulcrum. Fulcrum proposed a final year undergraduate project 9 months ago and our students have been successful in implementing the system. With signal processing, they achieved a 10dB noise reduction which is the same amount of reduction that can be found in very expensive noise reduction microphone[s]. A similar project had been tried three years ago but was unsuccessful due to the limits of the available technology."*

- 18 Given the date of the letter and knowing the results of the claimants' final year project, the reference to the "similar project...tried three years ago" is consistent with the claimants' own project. [The reference to the "final year undergraduate project 9 months ago" appears to be concerned with a similar but more successful implementation of a noise reduction system.] The claimants argue that this reference to their work strengthens the link between their project and the inventive concept underlying the invention, and demonstrates that at least one of the inventors could only have acquired the necessary technical knowledge by reference to their work.
- 19 In documents disclosed to the claimants as part of proceedings (exhibit DAR17.35), the claimants accept that David Townsend attended an advanced DSP course at Plymouth University in February 1998 where one of the lecturers was Professor Emmanuel Ifeachor, the same person who co-authored the DSP book referenced in the claimants' dissertation reports. The claimants argue that this further strengthens the link between their own work and the inventive concept underlying the patent, the inference being that the named inventors must have learned of Professor Ifeachor's work by reading the claimants' final year reports.
- 20 In his signed counter-statement, David Townsend says that he was appointed as Teaching Company Associate for the project and started work in October 1997. This is consistent with the minutes of the LMC meetings held on 27 May 1997 and 10 December 1997 (exhibits DAR17.20 and DAR17.30 respectively). At this point in time, the aim of the project was to design and develop microphone and complementary interface products. In DAR17.30, Bob Andrews, the Chair of the

LMC, is noted as saying that the Home Office were interested in the project and had told him that there were serious problems in the use of handsets in police vehicles and fire engines. Bob Andrews said that this was one of the markets he foresees for the results of the project. In his signed counter-statement, David Townsend says that the requirement for cancellation of siren noise from emergency vehicles came to the attention of the TCS project from a Mr Chris Bottomly of the Home Office's Validation and Installation Design Group, who said that the cancellation of siren noise had been tried unsuccessfully by others and proposed that the project should work on it.

- 21 The minutes of the LMC meeting in December 1997 (DAR17.30) notes that Robert Sherratt had looked at a Noise Cancelling Technologies (NCT) technique, "which is an adaptive process that removes periodic components". (NCT is an American organisation identified by David Townsend in a marked research study, who Fulcrum had discussed possible collaboration and use of their adaptive filtering techniques). The minutes say that Robert Sherratt reported "some Reading work on the removal of impulse-based noise and that there is scope for merging this technique with an adaptive algorithm". He is then noted as saying that the development of an adaptive algorithm from scratch could be a time-consuming process and that an upcoming short course on DSP at Plymouth University might be of great benefit to David Townsend.
- 22 In a subsequent report produced for the LMC meeting on 7 April 1998 (exhibit DAR17.40), David Townsend says that the Plymouth University course was "of great benefit and came at the right time to allow the project to significantly move forward and explore new ideas". In this report, the aim of the project is formally stated as being the design and development of a product that will allow suppression of siren noise transmitted over two-way radio link in emergency vehicles; the minutes of the meeting (exhibit DAR17.45) note this refinement in the aim of the project. In his report (DAR17.40), David Townsend says that before development work could begin on adaptive algorithms, it was necessary to gain an appreciation of emergency vehicle siren characteristics and that the Home Office had made recordings of various sirens available to Fulcrum.
- 23 In his report to the LMC meeting on 9 July 1998 (exhibit DAR 17.50), David Townsend reports that as a result of testing, it was decided to alter the structure of the "noise cancellator" to provide a separate reference input (siren only) and that this modification allowed attenuation levels in excess of 20dB to be accomplished. Further testing and development occurred between this date and the LMC meeting on 10 November 1998, the minutes of the November meeting (exhibit DAR19.6) noting that a patent application was in progress and that Fulcrum Systems had registered "SirenStop" as a trade mark.
- 24 The facts of the case can be summarised very briefly as follows. The claimants devised a digital system for reducing background noise from an input signal by subtracting an estimate of the background noise from the input source. The estimate of the background noise was derived by FIR filtering a noise reference signal using filter coefficients adjusted in accordance with an LMS adaptive algorithm applied to the output signal. The system did not perform as well as expected in reducing background speech, but it was suggested that it would be effective at reducing repetitive noise such as sirens in emergency service vehicles. Reading University and/or Fulcrum were aware of this system and of its potential applications. Some four years later, a joint collaboration project between Reading University and Fulcrum led

to a patent application being filed and then a patent granted for a noise cancelling system for use in emergency service vehicles. The defendant says that that the named inventors developed the invention independently of the claimants' work, although by his own admission it would appear that at least one of the named inventors was aware of the claimants' work.

- 25 So who contributed to the inventive concept underlying the invention? I shall turn first to the guidance concerning claims for sole and joint inventorship to be found in *Yeda*. As I have noted above, paragraph 21 says that "the effect of section 7(4) is that a person who seeks to be added as a joint inventor bears the burden of proving that he contributed to the inventive concept underlying the claimed invention and a person who seeks to be substituted as sole inventor bears the additional burden of proving that the inventor named in the patent did not contribute to the inventive concept."
- 26 By comparing the details of the noise reduction system developed by the claimants in 1995 as described in their dissertation reports (DAR11 and APB11) with the inventive concept of the patent, I have no doubt whatsoever that the claimants devised the exact same inventive concept set out in Fulcrum's patent. The defendant argues that the claimants' suggestion that their noise reduction system would be effective in cancelling emergency sirens was entirely speculative: it had not been tested and could not function in the way described because emergency sirens are not stationary signals of sine waveform and their frequencies are usually less than 1.5kHz. That may well be true, but these characteristics of the noise signal and the performance requirements of the system do not form a part of the inventive concept of the patent.
- 27 Having established that the claimants devised the same inventive concept as that set out in the patent, the next step is to consider whether their work contributed in any way to the inventive concept of the patent.
- 28 Given the striking similarity between the noise cancelling system developed by the claimants and that disclosed in the patent, as shown in the figures above, it would be very easy to jump to the conclusion that the claimants' work not only influenced the way in which the invention was developed but directly contributed to the inventive concept of the patent. However, it is the evidence regarding the development of the inventive concept that I need to take account of, not just the end result.
- 29 The claimants argue that the defendant did not arrive independently at the invention because they benefitted directly from their knowledge of the claimants' final year project and also indirectly through Chris Guy's involvement (and possibly Bob Andrews) in the TCS project. They also argue that the named inventors did not have the necessary technical skills to have developed the invention without the benefit of their work. I find that there is clear evidence of Chris Guy's involvement in the development of the inventive concept and that he was fully aware of the claimants' work, but there is no evidence to suggest that the named inventors did not have the technical expertise to develop the invention; on the contrary, I would say that the various technical reports produced by David Townsend demonstrate that he had a very sound understanding of the subject matter, and he also attended a DSP course in 1998 given by the author of the book which influenced the claimants' own work.
- 30 There is no evidence to show that Chris Guy discussed the claimants' work with the named inventors, although I would be very surprised if he did not. In their signed

counterstatements, both David Townsend and Robert Sherratt separately deny being aware of the claimants' dissertation reports, although in his letter to the TCS Programme administrators (DAR17.15), Robert Sherratt appears to contradict his own statement by referencing the claimants' work. This shows that at least one of the named inventors was aware of the claimants' work, so the question of whether he was informed of this work by Chris Guy is moot.

- 31 The various minutes of the LMC meetings and the project reports produced by David Townsend provide a contemporaneous account of the development of the invention from its inception to the filing of the patent application. It is clear from these documents that the invention developed from being something quite different to the end result and was modified at a late stage to include a separate noise reference signal as in the claimants' noise cancelling system (DAR17.50, dated June 1998). DAR17.30 notes that the focus on reducing noise in emergency vehicles arose from a discussion with the Home Office, and in his signed counter-statement, David Townsend says that it was Chris Bottomly from the Home Office who suggested this use. The minutes of the April 1998 meeting of the LMC (DAR17.45) note that David Townsend attended a DSP course at Plymouth University; this was in February 1998 and included a module on "Adaptive filter theory and applications" (DAR17.35), which David Townsend found to be extremely useful in allowing the project to move forward (DAR 17.40).
- 32 On the basis of the evidence before me concerning the development of the inventive concept, I find that even though the named inventors were aware of the claimants' work, the inventive concept developed incrementally through a process of trial and error quite independently of the claimants' work. David Townsend's attendance at the DSP course in Plymouth appears to have been a significant breakthrough in the project, which appears to have steered development towards a system for cancelling noise very similar to that of the claimants. It appears that the DSP course was as influential on the development of the inventive concept as Professor Ifeachor's book was on the claimants' final year project, and since the course covered the same topics as Professor Ifeachor's book then it is no surprise that the inventive concept bears a striking similarity to the claimants' system.
- 33 It follows from this that the claimants have been unable to prove that they contributed to the inventive concept underlying the claimed invention or that the named inventors did not.
- 34 I should note that I have not been asked to consider the issue of whether the patent is valid in light of the claimant's work and therefore I make no finding in this respect.

### **Conclusion**

- 35 The claimants have been unable to prove that they contributed to the inventive concept underlying the claimed invention or that the named inventors should not be so named. Their application under section 13 of the Act is dismissed.

### **Costs**

- 36 The defendant has asked for an award of costs in its favour. *Tribunal Practice Notice (TPN) 4/2007*<sup>3</sup> explains how costs are to be determined in proceedings before the

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<sup>3</sup> <http://www.ipo.gov.uk/pro-types/pro-tm/t-law/t-tpn/t-tpn-2007/t-tpn-42007.htm>

comptroller. It includes the standard scale that is usually applied, and also provides guidance concerning situations when the comptroller may award costs off the scale, for example the conduct of the parties in the proceedings. As I have already noted, the amount of evidence submitted by the claimants has been considerable (a lot of which I found to be irrelevant to the issue to be decided) and this would have required considerable time and effort on the part of the defendant to analyse and assess its worth. Counter to this is the claimants' preparedness to agree to having the issue decided on the papers, which will have saved the defendant the further cost of preparing for and attending a hearing. Taking all of this into account and including the costs deferred from the preliminary issue of entitlement to the patent, I order that the claimants pay the defendant a sum of £1500 as a contribution to its costs in these proceedings, this sum to be paid within seven days of the expiry of the period for appeal.

### **Appeal**

37 Any appeal must be lodged within 28 days.

**H Jones**

Deputy Director acting for the Comptroller