



decision.

### The invention

- 5 The invention relates to a method of processing seismic data or other geophysical data captured at irregular points over a multi-dimensional domain. The invention finds particular application in seismic imaging, which is described in the specification as the process of determining one or more parameters relating to the physical properties of the earth's interior from seismic measurements at the earth's surface. Seismic imaging is commonly used in the field of oil and gas exploration to determine the location of underwater or sub-surface oil and gas reserves.
- 6 The application states that seismic imaging requires integrals of the seismic data to be determined over an integration domain, and that such integrals have traditionally been computed using binning algorithms which work well if the data points are distributed on a regular grid pattern but less well if an unsatisfactory "binning grid" is applied. In other words, the reliability of a seismic image is reduced if an unsuitable binning grid is employed.
- 7 The invention seeks to improve upon the accuracy of prior art binning algorithms used in determining an integral of seismic data over an n-dimensional integration domain, and does so by partitioning the integration domain into a plurality of k-dimensional simplexes (where  $k \leq n$ ), integrating the seismic data over each simplex and then summing the results. In geometry, a simplex is defined as a figure with the minimum number of vertices for a space of a particular dimension, e.g. a triangle in a two dimensional space or a tetrahedron in a three dimensional space. Figure 1 of the application illustrates how a two-dimensional integration domain containing irregularly-spaced data points could be partitioned into a plurality of 2 dimensional simplexes, i.e. triangles.

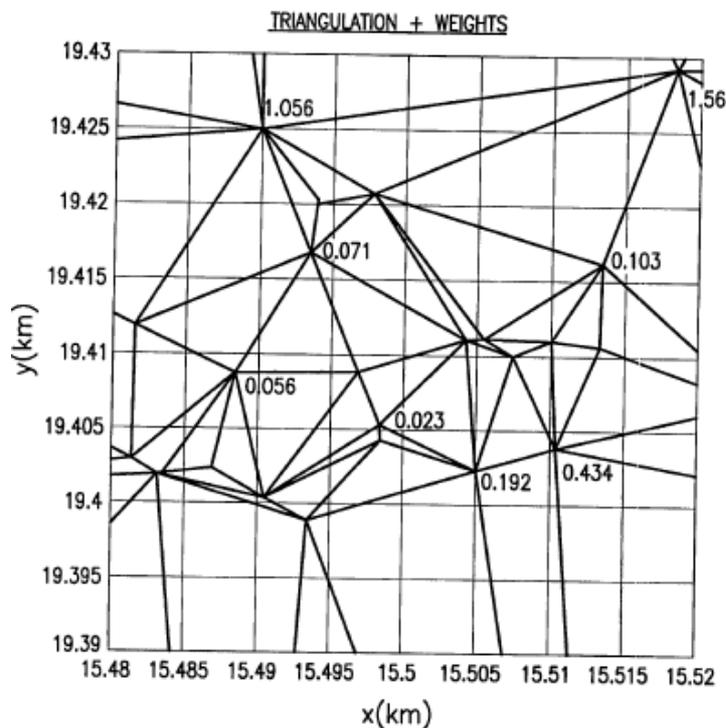


FIG. 1

- 8 An integral of the seismic data is computed from the seismic data available for each vertex of the triangle. Since the vertices of the triangles are chosen to be consistent with the irregularly-spaced data points, seismic data will always be available for each vertex, and the integral over each triangle may be determined by summing the values of the seismic data for each vertex of each triangle. The integrals over each triangle are then summed and used in deriving a seismic image.
- 9 The application has two independent claims directed to a method (claim 1) and an apparatus (claim 16) for processing geophysical data. Claims 1 and 16 share the same inventive concept, and for the purpose of this decision I need only recite one of them. Claim 1 reads as follows:
- “1. A method of processing geophysical data, the method comprising determining an integral of a function of the geophysical data over an n-dimensional integration domain from the values of the function at a plurality of discrete data points within the integration domain, wherein the method comprises the steps of:
- a) partitioning the integration domain into a plurality of k-dimensional simplexes, where  $k \leq n$ , wherein each vertex of a simplex is coincident with one of the data points;
- b) integrating the function over each simplex; and
- c) summing the results of step b).”
- 10 Other claims of note are claim 14, which is dependant upon claim 1 but ties the method of processing geophysical data to the determination of one or more parameters relating to the physical properties of the earth's interior, and claim 15 which defines a method of seismic surveying comprising the steps of propagating the seismic signals, acquiring the seismic data at a plurality of discrete locations, processing the data in accordance with the method of claim 1 and determining one or more parameters relating to the physical properties of the earth's interior. Claim 20 relates to a storage medium containing a program for controlling a programmable data processor to carry out a method as defined in claim 1.

### **The law**

- 11 The examiner argues that the claimed invention is excluded from patentability under section 1(2) of the Act, and in particular that it relates to a mathematical method, a mental act and a program for a computer under sections 1(2)(a) and 1(2)(c). The relevant parts of section 1(2) read:

*1(2) It is hereby declared that the following (among other things) are not inventions for the purposes of this Act, that is to say, anything which consists of -*

*(a) a discovery, a scientific theory or mathematical method;*

*(b) ...*

*(c) a scheme, rule or method for performing a mental act, playing a game or doing business, or a program for a computer;*

*(d) ...*

*but the foregoing provision shall prevent anything from being treated as an invention for the purpose of this Act only to the extent that a patent or application for a patent relates to that thing as such.*

12 These provisions are designated in section 130(7) as being so framed as to have, as nearly as practicable, the same effect as the corresponding provisions of the European Patent Convention (EPC), i.e. Article 52. As a consequence, I must therefore also have regard to the decisions of the Boards of Appeal of the European Patent Office (EPO) that have been issued under this Article in deciding whether the present invention is patentable.

13 At the hearing Dr Suckling referred to the EPO Board of Appeal's decision in *Vicom*<sup>3</sup> in support of his argument that the claimed method of processing seismic data was patentable. He argued, and indeed I agreed, that *Vicom* was particularly relevant to the present application because of the similarity in the subject matter of the two inventions - the invention in *Vicom* concerned a method of digitally processing images in the form of a two dimensional array which the Board of Appeal found to be patentable. This decision was fully considered by the Court of Appeal in arriving at its new test for patentability set out in *Aerotel/Macrossan*, and in doing so clearly took full account of its persuasive effect in assessing what is and what isn't a patentable invention under section 1(2). However, I shall return to Dr Suckling's point regarding the similarity in subject matter later in my decision.

### Interpretation

14 The correct approach to assessing patentability under section 1(2) is set out in the Court of Appeal's judgment in *Aerotel/Macrossan*, and comprises a four-step test as follows:

- 1) properly construe the claim
- 2) identify the actual contribution
- 3) ask whether the actual contribution falls solely within the excluded subject matter
- 4) check whether the contribution is actually technical in nature

15 Paragraphs 46 and 47 of the Court of Appeal's judgment provide further guidance regarding the fourth step of the test:

*"46. The fourth step - check whether the contribution is "technical" - may not be necessary because the third step should have covered that. It is a necessary check however if one is to follow Merrill Lynch as we must.*

*47. As we have said this test is a re-formulation of the approach adopted by this court in Fujitsu: it asks the same questions but in a different order. Fujitsu asks first whether there is a technical contribution (which involves two questions: what is the contribution? is it technical?) and then added the rider that a contribution which consists solely of excluded matter will not count as a technical contribution."*

### Arguments and analysis

16 So the first step I must take is to properly construe the claim, or as the Court put it, "to decide what the monopoly is before going on [to] the question of whether it is excluded." Since there is no dispute regarding the proper construction of claims 1 and 16, I can proceed immediately to the second step.

17 In the second step I must identify the actual contribution, which, as the Court rightly recognised, is more problematical as it involves an exercise of judgment "probably involving the problem said to be solved, how the invention works, what its advantages

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<sup>3</sup> T208/84

are.”<sup>4</sup> The Court also said that the formulation of the contribution involves looking at the substance of the invention and not the form.

- 18 In his last examination report dated 15<sup>th</sup> November 2006, the examiner identified the contribution as being broadly equivalent to the monopoly set out in claim 1, i.e. to a method of processing geophysical data comprising an integral of a function of the geophysical data over an n-dimensional integration domain from the values of the function at a plurality of discrete data points within the integration domain, wherein the method comprises the steps of a) partitioning the integration domain into a plurality of k-dimensional simplexes, where  $k \leq n$ , wherein each vertex of a simplex is coincident with one of the data points, b) integrating the function over each simplex, c) summing the results of step b).
- 19 Dr Suckling accepted this formulation of the contribution, but did express some concern regarding the examiner’s subsequent qualifier that “the key part of this contribution is that each vertex of the simplexes is coincident with respective one of the data points...although the claim is limited to how the geophysical data is collected and what they represent, these features are well known and so do not form part of the contribution.” Dr Suckling argued that there is no basis in *Aerotel/Macrossan* for assessing whether a sub-set of the actual contribution falls within the excluded subject matter; it is the contribution as a whole that must be assessed.
- 20 I agree with Dr Suckling on this point, and am happy to accept his assessment of the contribution made by the claimed invention as set out in paragraph 18 above.
- 21 The next step, step 3, is to ask whether the contribution falls solely within the excluded subject matter, which in this case the examiner considers to be a mathematical method, a mental act and a computer program. By way of guidance in answering this question, the examiner has referred to the hearing officer’s decision in *Institut du Francais Petrol & Elf’s Application*<sup>5</sup> (*Elf*), which relates to the patentability under section 1(2) of a method for building a stochastic model of the permeability of an underground zone for use in locating sub-surface oil bearing strata. Although this decision pre-dates the new test set out in *Aerotel/Macrossan* by some three years, the test applied at that time, i.e. as set out in *Fujitsu Limited’s Application*<sup>6</sup>, provides the same basis for the Court of Appeal’s new approach in *Aerotel/Macrossan* - see paragraph 47 of *Aerotel/Macrossan* quoted above. I interpret this to mean that the change in approach set out in *Aerotel/Macrossan* does not fundamentally change the boundary between what is and is not patentable in the UK, and that what was considered unpatentable three years ago should remain so to this day.
- 22 Whilst I have already dealt with the persuasive effect of *Vicom* in the light of *Aerotel/Macrossan*, i.e. that I am bound by the precedent of the Court of Appeal in the later case, Mr Mirza referred specifically to the analysis of the case law at paragraphs 80 to 85 of *Aerotel/Macrossan* in making the point that if *Vicom* was considered patentable in 1986 then it should also be patentable today. His point is the same as that made above in relation the *Elf*, i.e. that the boundary between what is and what isn’t patentable has not changed, and provides further guidance of what is regarded as excluded subject. Mr Mirza made the additional point that the guidance in *Vicom* carries more weight because of its approval by the Court of Appeal.
- 23 In the present case, the contribution can be seen to reside in the precise method of processing geophysical data, and Dr Suckling’s submission at the hearing was that

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<sup>4</sup> paragraph 43 of *Aerotel/Macrossan*

<sup>5</sup> BL O/201/03 [<http://www.ipo.gov.uk/patent/p-decisionmaking/p-challenge/p-challenge-decision-results/o20103.pdf>]

<sup>6</sup> [1997] RPC 608

limiting the new and inventive integration technique to real world data, i.e. geophysical data, takes the contribution beyond a mere mathematical method. This same issue arose in both *Elf* and *Vicom*, where two very different conclusions were seemingly reached because of the very different nature of the inventions in question. Or to be more precise, because of the difference in the contributions made by the two inventions. In *Vicom*, the Board of Appeal said at paragraph 5:

“There can be little doubt that any processing operation on an electric signal can be described in mathematical terms. The characteristic of a filter, for example, can be expressed in terms of a mathematical formula. A basic difference between a mathematical method and a technical process can be seen, however, in the fact that a mathematical method or a mathematical algorithm is carried out on numbers (whatever these numbers may represent) and provides a result also in numerical form, the mathematical method or algorithm being only an abstract concept prescribing how to operate on the numbers. No direct technical result is produced by the method as such. In contrast thereto, if a mathematical method is used in a technical process, that process is carried out on a physical entity (which may be a material object but equally an image stored as an electric signal) by some technical means implementing the method and provides as its result a certain change in that entity. The technical means might include a computer comprising suitable hardware or an appropriately programmed general purpose computer.”

24 In *Elf*, the hearing officer was able to draw a distinction between the invention in question and that in *Vicom*, and said at paragraph 24:

“In the present case, the results of the mathematical modeling process are produced as an image. This provides the engineer with statistical information about the permeability or other parameter of the zone of interest. The closest the specification comes to describing the eventual use of the information are such statements as; “the method according to the invention finds applications notably in the construction of a stochastic model of an underground formation.” and “the method allows to establish a connection between stochastic model adjustment and deterministic model adjustment by zoning conventionally used by reservoir engineers.” These do not in my view link the method to a physical process in the way the Board of Appeal found to be patentable.”

25 He went on to say at paragraph 27:

“Mr Black emphasized the point that the optimised realisation resulting from the method produces a result that is consistent with the production data and thus is representative of the zone. It seems to me that this point can not determine whether a method such as the present one is or is not patentable. A system which manipulates data and presents information resulting from the manipulation to an operator does not appear to me to become patentable simply because the data represents data from the real world. In fact I would imagine that any system that carries out data manipulation in the practical sciences will be working on data from the real world. This is certainly true of the inventions in the *Georges* and *Vicom* cases, but there it was the embedding of the method in a physical system which provided a technical effect, not the meaning of the data. Consequently, unless there is a functional link to a physical system, or conceivably some internal technical feature, such systems will be unpatentable since they simply manipulate data and the fact that data may represent physical parameters in the real world does not in my view, on its own, confer patentability on such systems.”

26 In *Vicom*, as far as I see it, the contribution lay in improving the resolution of an image by

subjecting the image data to a new and inventive mathematical technique. In other words, the problem to be solved lay in improving the resolution of a physical image, and the solution proposed by the applicant involved a new and inventive data processing technique able to produce the desired effect. The impetus for the inventors' creativity derived not from a desire to improve a mathematical method for the sake of it but to improve the resolution of a physical image; this, it seems to me, points to the contribution as extending beyond mere improvement of a mathematical method *per se*.

- 27 Again in *Elf*, as far I can see it, the contribution lay in building an optimised Gaussian related stochastic model which better represented a statistical distribution of a parameter found in sub-surface strata. The hearing officer said at paragraph 24 that "the arguments put forward in letters and at the hearing indicate that the [statistical] information is useful in saving time, cost, flexibility and efficiency in operating or evaluating a production process". He went on to say that the application gave "no explanation as to the use of the statistical model in any physical process", and "provided no functional link to a physical process, whether automatic or via human means". From this I take it that the novel and inventive improvements made to the mathematical method were derived solely for the benefit of improving the efficiency or flexibility of the mathematical method and that the inventors' contribution should be set in such a context. In doing so, one can easily see that the contribution falls wholly within an improvement to a mathematical method regardless of whether the method is applied to real world data or not.
- 28 Returning to the present case, I have already identified the contribution in claim 1 as being a method of processing geophysical data comprising an integral of a function of the geophysical data over an n-dimensional integration domain from the values of the function at a plurality of discrete data points within the integration domain, wherein the method comprises the steps of a) partitioning the integration domain into a plurality of k-dimensional simplexes, where  $k \leq n$ , wherein each vertex of a simplex is coincident with one of the data points, b) integrating the function over each simplex, c) summing the results of step b). It is clear that this contribution is not tied to the problem of improving the resolution of a seismic image as set out in the application nor indeed is it linked to the solution of such a problem.
- 29 Having had the opportunity to consider the decision in *Vicom* in some detail, I accept Dr Suckling's argument that the problem said to be solved by the present application is very similar to that addressed in *Vicom*, and that my finding on patentability should be consistent with that of the Board of Appeal. However, I have difficulty in doing so because the inventive contribution in claim 1 makes no reference to the same sort of problem or the same end result as set out in the claims considered by the Board of Appeal. If comparisons are to be made as Dr Suckling suggests, then I would say that the inventive contribution made in claim 1 bears a striking similarity to that considered in *Elf* in that it comprises nothing more than a method of processing real world data set out in the terms of specified functions and specified parameters. In contrast to the case in *Vicom*, I consider that this contribution falls wholly within the meaning of a mathematical method as set out in section 1(2) because the specified functions and parameters have no significance beyond the mere abstract manipulation of data. Had claim 1 addressed the end result of the mathematical method and that end result had involved a change in a physical entity - as was the case in *Vicom* - then the contribution would have extended beyond mere manipulation of data and my conclusion would have been different.
- 30 Turning to the remainder of the claims in the present application, one can quite easily see that claims 2-13 and 17-19 define minor modifications of the functions and/or the parameters of the data processing method set out in claim 1 (or claim 16 as the case may be) without extending the inventive contribution beyond the limits of a mathematical method. In other words, the contribution made in each of these claims falls solely within

the meaning of a mathematical method.

- 31 Claim 14 provides the additional step of determining one or more parameters relating to physical properties of the earth's interior from the processed geophysical data. This I believe is significant, because it shifts the contribution made by the invention of claim 14 towards that considered patentable in *Vicom*, i.e. the contribution not only involves a new and inventive mathematical method but also the application of the method in the production of seismic images. This contribution cannot be said to fall wholly within the meaning of a mathematical method because it involves the implementation of a data processing technique to produce as its result an improved seismic image. Similarly for claim 15, which again applies the data processing technique to the production of seismic images.
- 32 Claim 20 defines the invention in terms of a storage medium for controlling a programmable data processor to carry out a method as defined in any of claims 1 to 15. Patent Office practice as set out in its Practice notice dated 2<sup>nd</sup> November<sup>7</sup> is to regard such claims as defining a monopoly to a computer program per se and for the contribution to be similarly limited to being a program for a computer. At the hearing, Dr Suckling mentioned that this type of claim had been considered in *Bloomberg's Application*<sup>8</sup> and that this decision was currently the subject of an appeal before the Patents Court. Dr Suckling said that if the Court upheld this practice then he would be happy to delete this claim, but would need an opportunity to consider the Court's judgment in full before making such a decision. Not wanting to delay my decision unnecessarily, I agreed to take further submissions on this specific issue provided that the Court handed down its judgment within two months of the date of the hearing. In the event, the Court's judgment was handed down on 13<sup>th</sup> March 2007 and a further submission was received shortly afterwards on 23<sup>rd</sup> March 2007. In his submission, Dr Suckling maintained the offer to remove this claim if the continued view of the Patent Office was to reject this type of claim.
- 33 Having considered the contribution made by each claim of the application in turn, I have found that the contribution made in claims 1-13 and 16-19 falls solely within the meaning of a mathematical method set out in section 1(2), and that Patent Office practice requires me to find that the contribution made by claim 20 falls solely within the meaning of a program for a computer. Having found that claims 1-13 and 16-19 are not patentable as mathematical methods then it is not necessary for me to consider whether they are also excluded as mental acts or computer programs. Similarly for claim 20, I have found that it relates to a program for a computer and deciding whether it also relates to a mathematical method or a mental act would be a purely academic exercise.
- 34 I have found that the contribution made in claims 14 and 15 does not fall solely within the meaning of a mathematical method and that this is consistent with the guidance on what is and isn't a mathematical method provided in *Vicom*. I have not considered yet whether claims 14 and 15 relate to a program for a computer or to a mental act, but do not need to labour the point too much because it is fairly obvious to me that the contributions made do not relate to specific instruction for processing data within a computer processor nor are they methods that could be carried out mentally.
- 35 In the case of claims 1-13 and 16-20 I have decided that the contribution relates solely to excluded matter and therefore it is not necessary for me to proceed to the fourth step of considering whether or not the contribution is technical in nature. For claims 14 and 15, the answer to whether the contribution is technical in nature is quite straightforward

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<sup>7</sup> <http://www.ipo.gov.uk/patent/p-decisionmaking/p-law/p-law-notice/p-law-notice-subjectmatter.htm>

<sup>8</sup> BL O/151/06

because the data processing technique clearly produces an improved physical entity and involves technical means for its implementation.

### **Conclusion**

- 36 I have found that the inventions defined by claims 1-13 and 16-20 relate to a mathematical method and to a program for a computer as such and are excluded from patentability under sections 1(2)(a) and 1(2)(c) of the Act. I have also found that claims 14 and 15 do not relate to inventions excluded from patentability under section 1(2). As a consequence, the application will be remitted to the examiner to continue processing of the application.

### **Appeal**

- 37 Under the Practice Direction to Part 52 of the Civil Procedure Rules, any appeal must be lodged within 28 days.

**H Jones**

Deputy Director acting for the Comptroller